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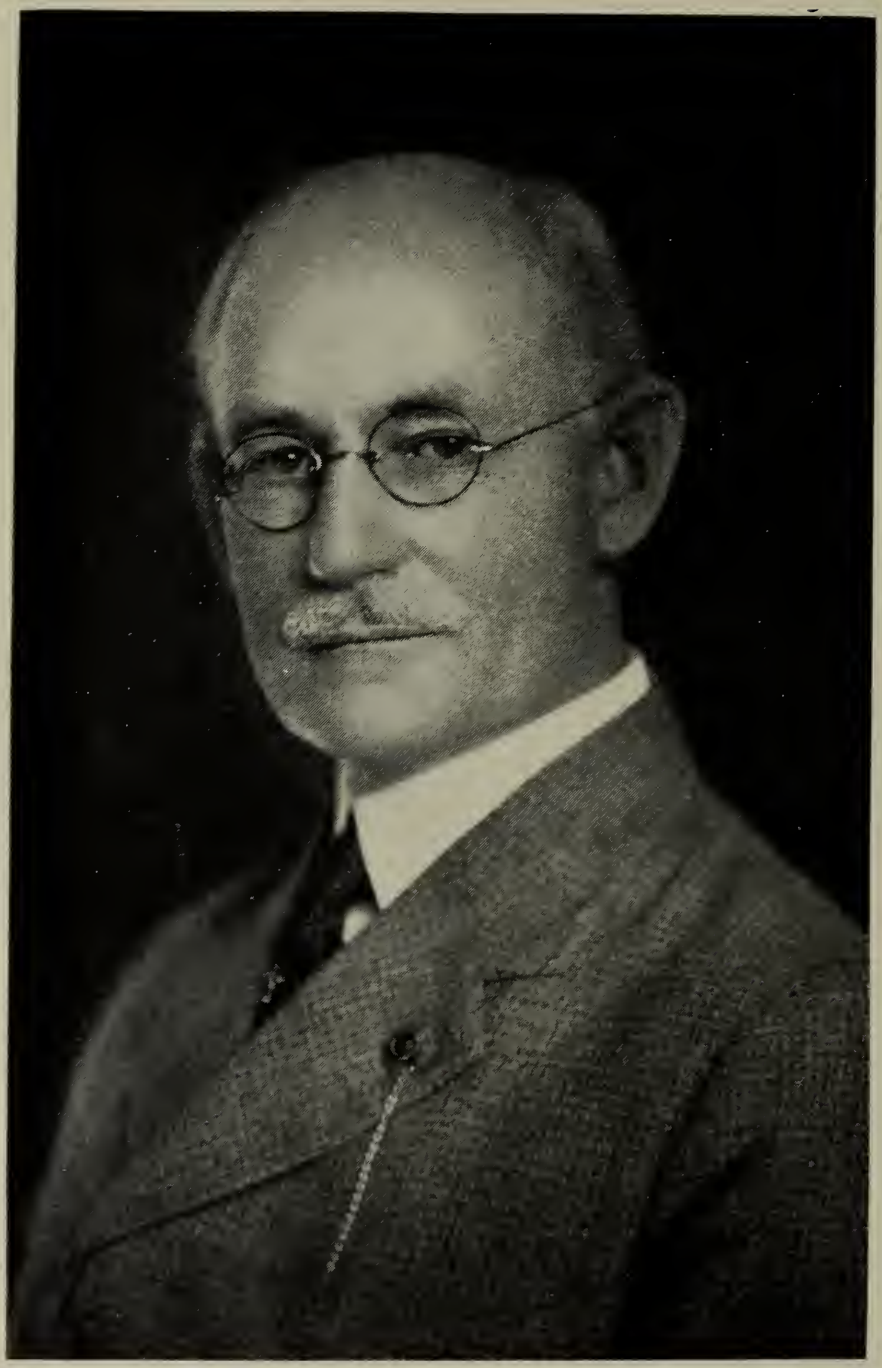

CHARLES D. LOCKWOOD

PRESIDENT, 1921

CAT.

THIRTY-FIRST ANNUAL MEETING

TRANSACTIONS

OF THE

WESTERN SURGICAL ASSOCIATION

Thirty-first Annual Meeting

St. Louis, Mo., December, 9 and 10, 1921

MINNEAPOLIS
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OFFICERS AND EXECUTIVE COMMITTEE

1922

PRESIDENT

Miles F. Porter, M. D. - - - Fort Wayne, Ind.

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SECRETARY-TREASURER

Warren A. Dennis, M. D. - - - St. Paul, Minn.

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Charles D. Lockwood, M. D. Chairman, Pasadena, Cal.

Arthur T. Mann, M. D. - - Minneapolis, Minn.

Roland Hill, M. D. - - - - - St. Louis, Mo.

William T. Coughlin, M. D. - - St. Louis, Mo.

Jabez N. Jackson, M. D. - - - Kansas City, Mo.

EX-PRESIDENTS AND MEETING PLACES

PRESIDENT	PLACE	YEAR
S. S. Todd*	Topeka	1891
Milo B. Ward*	Kansas City	1892
Milo B. Ward*	Des Moines	1893
Lewis Schooler	Omaha	1894
John E. Summers, Jr.	Kansas City	1895
Thomas J. Beattie	Topeka	1896
Joseph Eastman*	Denver	1897
David S. Fairchild	Omaha	1898
Homer C. Crowell	Des Moines	1899
O. Beverly Campbell	Minneapolis	1900
August F. Jonas	Chicago	1901
James E. Moore*	St. Joseph	1902
Alex. Hugh Ferguson*	Denver	1903
Charles H. Mayo	Milwaukee	1904
Harvey D. Niles*	Kansas City	1905
Malcolm L. Harris	Salt Lake City	1906
Charles W. Oviatt*	St. Louis	1907
William W. Grant	Minneapolis	1908
Arthur L. Wright*	Omaha	1909
John P. Lord	Chicago	1910
Amos W. Abbott	Kansas City	1911
Lewis L. McArthur	Cincinnati	1912
Jabez N. Jackson	St. Louis	1913
Byron B. Davis	Denver	1914
Joseph Rilus Eastman	Des Moines	1915
Lawrence W. Littig*	St. Paul	1916
Leonard Freeman	Omaha	1917
James F. Percy	Chicago	1918
Roland Hill	Kansas City	1919
Mann, Arthur T.	Los Angeles	1920
Lockwood, Charles D.	St. Louis	1921

*Deceased.

The Western Surgical Association does not hold itself responsible for, or necessarily endorse, any of the papers printed herein.

WARREN A. DENNIS, M. D., Secretary-Treasurer

CONTENTS

Officers and Executive Council 5

Ex-Presidents and Meeting Places 7

Transactions 11

PAPERS

President's Address: The General Surgeon, Past, Present, and Future. Charles D. Lockwood, M. D., F. A. C. S., Pasadena, California 23

Acute Osteomyelitis: Regeneration of the Entire Shaft of the Humerus. Frank G. Nifong, M. D., F. A. C. S., Columbia, Missouri 39

Pathology of Osteomyelitis, With Special Reference to Growing Bone. Arthur C. Stokes, B. Sc., M. D., F. A. C. S., Omaha, Nebraska 51

The Pathology of Carpal Bone Fracture—Dislocations. Kellogg Speed, M. D., F. A. C. S., Chicago, Illinois 61

The Lesser Injuries to the Back and Their Industrial Significance. Oliver J. Fay, M. D., F. A. C. S., Des Moines, Iowa 71

Radical Surgery as an Aid to Efficient Radiotherapy in the Apparently Hopeless Cases of Carcinoma. Emil G. Beck, M. D., F. A. C. S., Chicago, Illinois 85

Total Removal of the Scapula for Primary Giant-Cell Sarcoma. Byron B. Davis, A. B., M. D., F. A. C. S., Omaha, Nebraska 117

Common Duct Repair. Lewis L. McArthur, M. D., F. A. C. S., Chicago, Illinois 131

Cholecystostomy or Cholecystectomy—Which? Miles F. Porter, M. D., F. A. C. S., Fort Wayne, Indiana 145

The Acute Traumatic Belly. T. C. Witherspoon, M. D., F. A. C. S., Butte, Montana 159

The Non-Traumatic "Acute Abdomen". W. W. Grant, M. D., F. A. C. S., Denver, Colorado 173

Intestinal Obstruction. Gilbert Geoffrey Cottam, M. D., F. A. C. S., Sioux Falls, South Dakota 187

Diaphragmatic Hernia. Arthur T. Mann, M. D., F. A. C. S., Minneapolis, Minnesota 199

Sciatic Hernia. Report of a Case Complicated with Myxomatous Tumor of the Scrotum. John Edward Summers, M. D., F. A. C. S., Omaha, Nebraska 211

Injuries of the Face and Jaws. W. T. Coughlin, M. D., F. A. C. S., Saint Louis, Missouri 223

A Continuous Knotted Loop Suture: Its Field of Application. Joseph Rilus Eastman, M. D., F. A. C. S., Indianapolis, Indiana 233

Blood Pressure in Surgical Cases. J. F. Corbett, M. D., F. A. C. S., Minneapolis, Minnesota 247

The Recognition and Treatment of Post-operative Complications. Frederick W. Bailey, M. D., F. A. C. S., St. Louis, Mo. 253

Some Modern Methods of Minimizing Mortality in Surgical Cases, with Report of the Mortality in 1518 Surgical Cases at the Holy Cross Hospital, Salt Lake City, Utah, from January 1 to September 1, 1921. A. A. Kerr, M. D., F. A. C. S., Salt Lake City, Utah 297

Traumatic and Industrial Hernia. Report of the special Committee of the Medical Section of the American Railway Association 311

Excision of Ulcer of the Duodenum. E. Starr Judd, M. D., F. A. C. S., Rochester, Minnesota 333

Ectopic Pregnancy. John L. Evans, M. D., F. A. C. S., Wichita, Kansas 345

Papillary Cystadenoma of the Male Breast. Vernon C. David, M. D., F. A. C. S., Chicago, Illinois 361

Tumors of the Breast. Carl E. Black, A. M., M. D., F. A. C. S., Jacksonville, Illinois 371

Surgical Treatment of Abscess of the Lung. Oscar M. Shere, M. D., F. A. C. S., Denver, Colorado 389

Tuberculous Empyema. Lewis H. McKinnie, M. D., F. A. C. S., Colorado Springs, Colorado 401

Perirectal Abscess Complicating Intraperitoneal Infections. J. Louis Ransohoff, M. D., F. A. C. S., Cincinnati, Ohio 413

In memoriam 417

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Executive Session

TRANSACTIONS OF THE THIRTY-FIRST ANNUAL MEETING, HELD IN ST. LOUIS, MISSOURI DECEMBER 9 AND 10, 1921

DECEMBER 9—FIRST DAY—MORNING SESSION

The Association met at the Statler Hotel, and was called to order at 9:30 A. M. by the President, Dr. Charles D. Lockwood, Pasadena, California.

Dr. Frank G. Nifong, Columbia, Missouri, read a paper entitled "Acute Osteomyelitis: Regeneration of the Entire Humerus."

Dr. Arthur C. Stokes, Omaha, Nebraska, read a paper entitled "Pathology of Chronic Osteomyelitis."

These two papers were discussed together by Drs. Mann, and Speed, after which the discussion was closed by Dr. Nifong.

Dr. William E. Leighton, St. Louis, Missouri, Chairman of the Local Committee of Arrangements, announced that the banquet would be held this evening at the Missouri Athletic Club. He also stated that the wives of the local members would entertain the visiting ladies.

Dr. Kellogg Speed, Chicago, Illinois, read a paper entitled "Pathology of Fracture-Dislocation of the Carpal Bones," which was discussed by Drs. Hessert, David, Porter, Vaughan, and, in closing, by the essayist.

Dr. Allen B. Kanavel, Chicago, Illinois, read a paper on "Tuberculous Infections of the Tendon Sheaths of the Hand," which was discussed by Drs. Shere and Hertzler.

Dr. Oliver J. Fay, Des Moines, Iowa, read a paper on "The Lesser Injuries to the Back and Their Industrial Significance," which was discussed by Drs. Porter, Plummer, Jepson, Harris, Reynolds, Hopkins, and, in closing, by the essayist.

Dr. Emil G. Beck, Chicago, Illinois, read a paper entitled "What Can Be Done in the Apparently Hopeless Recurrent Cases of Carcinoma and Sarcoma?"

Dr. Byron B. Davis, Omaha, Nebraska, followed with a paper entitled "Total Removal of the Scapula for Sarcoma Primarily in the Scapula."

These two papers were discussed together by Drs. Percy, Porter, Hertzler, Lockwood, Beck, and, in closing, by the essayist.

Dr. Jabez N. Jackson, Kansas City, Missouri, called attention to the illness of Dr. John F. Binnie, a member of the Association, and moved that the Secretary be instructed to wire Dr. Binnie a message of condolence and sympathy of the Association, with best wishes for his recovery.

Seconded and carried.

On motion, the Association adjourned until 2 P. M.

First Day—Afternoon Session

The Association reconvened at 2 P. M. and was called to order by the President.

Dr. Lewis L. McArthur, Chicago, Illinois, read a paper entitled "An Original Method of Repair of Injuries to the Common Duct," which was discussed by Drs. Hertzler, Kanavel, Harris, and, in closing, by the essayist.

Dr. Miles F. Porter, Fort Wayne, Indiana, read a paper entitled "Cholecystectomy or Cholecystostomy, Which?"

This paper was discussed by Drs. Jackson, Davis, Bartlett, Graham, and, in closing, by the essayist.

Dr. T. Casey Witherspoon, Butte, Montana, read a paper entitled "The Acute Traumatic Belly."

Dr. W. W. Grant, Denver, Colorado, followed with a paper on "The Acute Abdomen (Non-traumatic)."

These two papers were discussed jointly by Drs. Reynolds, Porter, Macrae, Bendixon, Percy, and Dyas, after which the discussion was closed by the essayists.

Dr. Gilbert G. Cottam, Sioux Falls, South Dakota, read a paper entitled "Intestinal Obstruction" which was discussed by Drs. Macrae, Haines, Twyman, MacLean, Summers, and, in closing, by the essayist.

Dr. Arthur T. Mann, Minneapolis, Minnesota, read a paper entitled "Diaphragmatic Hernia," which was discussed by Drs. Dennis, Riggs, Shere, Evans, Yates, and, in closing, by the essayist.

Dr. John E. Summers, Omaha, Nebraska, read a paper entitled "Sciatic Hernia and Myxomatous Tumor of the Scrotum in the Same Individual."

This paper was discussed by Dr. Stokes, and, in closing, by the essayist.

On motion, the Association adjourned until 9 A. M. Saturday, December 10.

At the banquet, Friday evening, December 9, the President, Dr. Charles D. Lockwood, delivered his address. He selected for his subject "The General Surgeon: Past, Present and Future."

December 10—Second Day—Morning Session

The Association met at 9 A. M. and was called to order by the President.

Dr. William T. Coughlin, St. Louis, Missouri, read a paper entitled "Injuries of the Face and Jaws," which was discussed by Drs. Speed, Percy, and, in closing, by the essayist.

Dr. Joseph Rilus Eastman, Indianapolis, Indiana, read a paper entitled "A Continuous Knotted Loop Suture: Its Many Uses," which was discussed by Dr. Benjamin.

A paper by Dr. J. F. Corbett, Minneapolis, Minnesota, on "The Value of Blood Pressure Determination," was read by title.

Dr. John L. Yates, Milwaukee, Wisconsin, read a paper entitled "Some Surgical Aspects of Myocardial Deficiency."

Dr. Fred W. Bailey, St. Louis, Missouri, read a paper entitled "The Recognition and Treatment of Post-operative Complications."

These two papers were discussed together by Drs. Jackson, Lewis, Judd, Sweetser, Grant, Porter, and Benjamin, after which the discussion was closed by Dr. Bailey.

Dr. Archibald A. Kerr, Salt Lake City, Utah, read a paper entitled "Some Modern Methods of Minimizing Mortality in Surgical Cases," which was discussed by Dr. David.

At this juncture the Second Vice- President, Dr. Harry P. Ritchie, St. Paul, took the chair.

Dr. Clarence W. Hopkins, Chicago, Illinois, read a report on "Traumatic and Industrial Hernia" prepared by a special committee of the Medical Section of the American Railway Association.

This report was discussed by Drs. Haines, Bartlett, Fay, Twyman, and Fairchild.

At the conclusion of the discussion, Dr. Oliver J. Fay offered the following resolution:

RESOLVED, That the report of the special committee on so-called traumatic and industrial hernia of the Medical Section of the American Railway Association be approved and adopted as the consensus of opinion of the Western Surgical Association.

The resolution was seconded by Dr. Willard Bartlett and carried unanimously.

On motion the Association adjourned until 2 P. M.

SECOND DAY—AFTERNOON SESSION

The Association reconvened at 2 P. M. and was called to order by the President.

Dr. E. S. Judd, Rochester, Minnesota, read a paper entitled "Excision of Ulcer of the Duodenum."

Secretary Dennis presented the report of the Executive Council as follows:

REPORT OF THE EXECUTIVE COUNCIL

At the meeting of the Executive Council of the Western Surgical Association held at the Hotel Statler in St. Louis on December 9 and 10, 1921, the following members were present:

Dr. Arthur T. Mann.

Dr. Roland Hill.

Dr. James F. Percy.

Dr. August F. Jonas.

Dr. William T. Coughlin.

President, Dr. Charles D. Lockwood.

Secretary, Dr. Warren A. Dennis.

Minneapolis was decided upon as the next place of meeting, the exact date to be fixed by the Executive Council.

Dr. Arthur T. Mann was named as Chairman of the Committee of Arrangements.

As officers for the ensuing year, the following were nominated:

President, Dr. Miles F. Porter, Fort Wayne, Indiana.

First Vice-President, Dr. Vilray P. Blair, St. Louis, Missouri.

Second Vice-President, Dr. J. Frank Corbett, Minneapolis, Minnesota.

Secretary-Treasurer, Dr. Warren A. Dennis, St. Paul, Minnesota.

For Executive Council:

Dr. Charles D. Lockwood, Pasadena, California, Chairman.

Dr. Arthur T. Mann, Minneapolis, Minnesota.

Dr. Roland Hill, St. Louis, Missouri.

Dr. William T. Coughlin, St. Louis, Missouri.

Dr. Jabez N. Jackson, Kansas City, Missouri.

The following three members were nominated for members of the Board of Governors of the American College of Surgeons:

Dr. August F. Jonas, Omaha, Nebraska.

Dr. Samuel C. Plummer, Chicago, Illinois.

Dr. Robert C. Coffey, Portland, Oregon.

The following named applicants were recommended for election to membership:

Dr. William L. Brown, El Paso, Texas.

Dr. James B. Eagleson, Seattle, Washington.

Dr. Carl. A. Hedblom, Rochester, Minnesota.

Dr. Lewis B. Morton, Los Angeles, California.

Dr. Thomas G. Orr, Kansas City, Missouri

Dr. Louis Rassieur, St. Louis, Missouri.

Dr. Ernest Sachs, St. Louis, Missouri.

Dr. Frank J. Tainter, St. Louis, Missouri.

Messages expressing regret at their inability to attend the meeting because of illness of themselves or of immediate members of their families were received from:

Dr. Amos W. Abbott, Minneapolis, Minnesota.

Dr. Abraham L. Blesh, Oklahoma City, Oklahoma.

Dr. J. Frank Corbett, Minneapolis Minnesota, and from the Secretary of Dr. James T. Case, of Battle Creek, Michigan.

The Secretary desires to state that the message of sympathy and best wishes to Dr. John F. Binnie, of Kansas City, as directed by action of the Association, has been sent.

The Association in the past year has suffered the loss by death of three honored and faithful members:

Dr. Joseph Ransohoff, Cincinnati, Ohio.

Dr. Charles T. Lemon, Milwaukee, Wisconsin.

Dr. St. Elmo M. Sala, Rock Island, Illinois.

At the request of the Secretary appropriate biographical sketches have been prepared by Dr. Willard

D. Haines, Dr. John L. Yates, and Dr. David S. Fairchild, Sr., which will appear in the published Transactions of the 1921 meeting.

In explanation for the late appearance of the Transactions, the Secretary desires to state the journals in which the papers of the members are published require that they should not have appeared previously in print, and that, therefore, the Transactions cannot appear until the last paper has been published. The only way, therefore, by which it is possible to secure an earlier publication of the Transactions is for all members appearing on the program to request that their papers be given places in the respective journals as early as possible.

(Signed) Warren A. Dennis, M. D.

Secretary.

Treasurer's Report

Receipts

Balance on hand December, 1920	$1,224.20
Toal amount received from dues December 1, 1920, to December 1, 1921	1,749.00
	$2,973.20

Disbursements

Expense of Los Angeles banquet and meeting	$225.95	
W. L. Klein for publication 1919 transactions	1,475.15	
Whitehead and Hoag Co. for emblems for the 1920 meeting	52.94	
Wm. Whitford, for reporting the 1920 meeting	120.00	
Exchange charges on Canadian check	1.62	
W. A. Keller Company, for printing stationery, circular letters, preliminary programs, programs, etc	110.80	
Stamps	20.00	
Ledger	1.50	

Whitehead and Hoag Co. for emblems for 1921 meeting	46.54	
Secretary's honorarium	100.00	
Total expenditures	$2,154.50	
		$2,973.20
		2,154.50
Balance on hand December 1, 1921		$818.70

It was recommended that the dues for the ensuing year remain at $12.00.

(Signed) WARREN A. DENNIS, Treasurer.

THE PRESIDENT: You have heard the report of the Executive Council. What disposition do you wish to make of it?

DR. WILLARD D. HAINES: I move the adoption of the report as read.

Seconded and carried.

Dr. Edmund D. Clark, Indianapolis, Indiana, offered the following resolution, which was unanimously adopted:

WHEREAS, The management of the Hotel Statler have been guilty of breaking faith with the Committee of Arrangements to the great inconvenience of the members of this Association in assigning them rooms as promised; therefore, be it.

RESOLVED, That the Western Surgical Association condemns the action of the management in this matter as unfair and reprehensible, and suggests that the Committee of Arrangements convey this action of the Western Surgical Association to the head of the Statler Hotel Corporation and to the Chamber of Commerce of St. Louis.

The President appointed Drs. Jabez N. Jackson and Donald Macrae to escort the newly elected President, Dr. Miles F. Porter, to the platform.

Dr. Porter was escorted to the platform amid great applause.

The Association then proceeded with the scientific program.

Dr. John L. Evans, Wichita, Kansas, read a paper entitled "Ectopic Pregnancy."

This paper was discussed by Drs. Reynolds, Dennis, Sweetser, Vaughan, Davis, Williams, Haines, Lockwood, Evans, Mann, Macrae, Jackson, and, in closing, by the essayist.

Dr. G. G. Cottam: The Local Committee of Arrangements has labored under considerable difficulties in handling this meeting, owing to an unfortunate situation with which you are all familiar, but in spite of it we have had a most successful meeting. Therefore, I move at this time that a vote of thanks be extended to the Committee of Arrangements for its good work.

Seconded and carried.

Dr. Vernon C. David, Chicago, Illinois, read a paper entitled "Papillary Cystadenoma of the Male Breast."

Dr. Carl E. Black, Jacksonville, Illinois, read a paper entitled "Some Points from an Analysis of 100 Cases of Tumor of the Breast."

These two papers were discussed jointly by Drs. Davis, Percy, Haines, Reynolds, Porter, and Williams, after which the discussion was closed by Dr. Black.

Dr. Oscar M. Shere, Denver, Colorado, read a paper on "Surgical Treatment of Lung Abscess," which was discussed by Drs. Graham, Vaughan, Lockwood, and, in closing, by the essayist.

Dr. Lewis H. McKinnie, Colorado Springs, Colorado, read a paper on "Tuberculous Empyema," which was discussed by Dr. Shere, and, in closing, by the essayist.

There being no further business to come before the meeting, on motion, which was duly seconded and carried, the Association adjourned to meet in Minneapolis, Minnesota, in 1922.

WARREN A. DENNIS, M. D.

Secretary-Treasurer.

President's Address

THE GENERAL SURGEON, PAST PRESENT, AND FUTURE

CHARLES D. LOCKWOOD, M. D., F. A. C. S.

PASADENA, CALIFORNIA

Mr. Chairman, Visiting Guests, and Members of the Western Surgical Association:

Before addressing you upon the subject which I have chosen for my annual address, I wish to express to my fellow members my profound appreciation of the honor conferred upon me one year ago when I was elected President of this Association. I crave no higher honor than to be counted among the distinguished men who have served as presiding officers of this Association in the past.

This Association is animated by the spirit of progress and enthusiasm which dominates the West, and I see for it an era of achievement and usefulness commensurate with the industrial development of our great Western empire. Unhampered by the traditions and prejudices of an older civilization, infused with the ideals and enthusiasm of the younger generation of surgeons, it is destined to fill an important place in the future development of surgery. Membership in this Association is coming to be the goal of every ambitious young surgeon in the Western States and we should see to it that only such men as will

contribute something to the art and science of surgery find a place on our membership roll. I would suggest that in addition to the existing requirements each new member, on the occasion of his inauguration into this Association, be required to present some evidence of his qualification in the form of a piece of original work, a special study of some limited field of surgery or some original instrument or device. It should be the function of this young and growing Association to stimulate original research and to discover and encourage the unusual man entering the field of surgery.

The contributions of the general surgeon to scientific medicine constitute no small part of the sum total of our present-day knowledge. The surgeon of the past belonged to that long era preceding the discovery of asepsis and anesthetics. This period was comparatively sterile, and the practice of surgery was limited to emergencies and to operations of necessity. Manual dexterity was the *sine qua non* of the ancient surgeon, and little was known of the fundamental sciences which have contributed so largely to medicine and surgery in the past twenty-five years. And yet there were a few beacon lights in the early history of surgery which stood out with startling brilliancy and pointed the way to our present achievement.

Foremost among these early teachers and investigators in the field of medical science was the great Hippocrates. Even in the light of modern-day knowledge, many of his observations in surgery startle us with their clearness and accuracy. His directions for the treatment of wounds conform closely to the modern principles of surgery, modified only by our added knowledge of bacteriology. He was the first to dignify the use of the human hand in the service of mankind; and in so exalting the ministry of healing he laid the foundations of modern surgery.

Little of value was added to the development of surgery from the days of Hippocrates until the time

of Galen. This man was learned in all the philosophies of his day, and he introduced methods of experimentation which greatly widened the field of medical knowledge. To him belongs the credit of first describing the cranial nerves and the sympathetic nervous system. He was a pioneer in animal experimentation; and, as a result of his dissections and experiments upon animals, it was discovered that aphonia follows division of the recurrent laryngeal nerve, that paraplegia results from division of the spinal cord, that loss of power ensues when a muscle is divided, and that the urine is conveyed from the kidney to the bladder along the ureter.

Despite his great discoveries in physiological anatomy, he made little practical application of them to human beings; and his speculative tendencies so dominated the minds of his followers that for fifteen hundred years the true significance of his discoveries did not become manifest. The only important contributions to surgery prior to the sixteenth century, apart from those of Hippocrates and Galen, were in the field of anatomy. So great was the authority of these two men that none dared to question their teachings or attempt to add anything to them. For centuries "The Sacred Flame of Science" was all but extinguished, and medicine suffered no less than other branches of learning. Notable contributions to anatomy, however, were made during the sixteenth century, and this knowledge paved the way for the great discoveries that were to come in later years. Anatomy, physiology, pathologic anatomy, anesthesia, and asepsis—these were the foundation stones upon which the temple of surgery was to be built.

The first human dissections were made in Alexandria, Egypt, although Alcmaeon, the Pythagorian, as early as 500 B. C. made dissections of the brain and taught that all sensation was carried to the brain by the nerves. It was in Egypt that Galen is supposed to have gained his knowledge of anatomy.

The greatest of all ancient anatomists was Andreas Vesalius, who lived and worked between the years 1514 and 1564. Unable to find material and opportunities for dissection in his native country of France, he went to Italy and in the atmosphere of the great University of Padua found his opportunity and made many valuable additions to the science of anatomy. His anatomic illustrations are works of art and have never been excelled for clearness and accuracy. Under the same influence a little later appeared those great Italian anatomists,—Eustachius, Fallopius, Fabricus, and Sylvius, whose names have been given to the structures which they describe, and who did much to place the study of anatomy upon a secure basis.

Inspired by the work of these Italian masters, William Harvey undertook his investigation of the valves of the veins and, in 1628, announced his discovery of the circulation of the blood. This startling discovery, at first ridiculed and viewed with incredulity, was finally accepted by all students of anatomy and opened the way for the study of physiology. Our knowledge of anatomy is almost complete, but we are only at the threshold of physiologic research.

Modern surgery owes much to the discovery of Harvey, for a knowledge of the circulation and its relation to the life and function of the organs of the body is essential to successful surgery. At last, after centuries of speculation and superstition, there emerged a clear cut conception of structure and function as a basis for the study of disease. It was a natural step from the study of the normal to the abnormal and a knowledge of pathologic anatomy was the next great need of surgery.

This need was met by the great John Hunter, perhaps the greatest figure in the annals of surgery. A bold surgeon, a fearless investigator, and an indefatigable worker, he ignored the traditions of his day and submitted every problem in surgery which confronted him to the test of experiment. He laid a se-

cure foundation for surgery in his studies of pathologic anatomy. Many of our early American surgeons sat at his feet, and his influence dominated the medical education of this country for fifty years. American surgery originated in the schools of London and Edinburgh.

The first medical school in America was organized in 1765. Prior to that time, and even as late as 1800, it was customary for men seeking special knowledge in surgery to take postgraduate courses in London and in Edinburgh. At this early date, even in England and in Europe, surgery had barely attained the position of an independent specialty, although prominent surgeons were striving to establish special courses in surgery in the curricula of medical schools. Instruction in surgery was subordinated to medicine. It was usually combined with lectures on anatomy and obstetrics. Little more was taught than bandaging and a few recognized operations. In many of the great centers of population, however, both in England and in Europe, there were bold spirits whose instincts and natural endowments led them into the field of surgery, and they endeavored to establish it in the position of an independent art and science. Among these ardent exponents of surgery in England were John Hunter, Percival Pott, Everhard Home, John Abernethy, and Astley P. Cooper. In Edinburgh were John and Charles Bell and three generations of Monroes who were famous in surgery.

Many of our early American surgeons sat at the feet of these teachers and from them gathered the inspiration that later found expression in the medical schools of this country. Although there were a number of skilled surgeons in Paris at this period, they had little influence upon the development of surgery on this continent.

Surgery, perhaps more than any other branch of medicine, is transmitted directly from master to pupil, and the dominating influence in the early development

of American surgery was British. American surgery, however, soon took on an independent character and broke away from the traditions which fettered the older civilization of Europe and retarded the progress of scientific surgery.

This independent spirit was attributed by foreign surgeons to ignorance of the established rules of practice or to recklessness, but it was the outgrowth of our free institutions and our isolation and natural resourcefulness. Our early surgeons were frequently confronted by serious emergencies which they were compelled to meet unaided by counsel and without the guide of precedent. These experiences developed an independence of thought and action which have characterized the surgery of this country up to the present time.

As early as 1792 a chair of surgery was established in the medical department of Columbia University, and Dr. Wright Post was its first occupant. Among the other surgeons who influenced the early development of surgery in America should be mentioned John Jones, John Warren, Valentine Mott, Willard Parker, Philip Syng Physick, who has been styled "The Father of American Surgery," and D. Hayes Agnew. These men exhibited a boldness and originality in the face of handicaps which to the present-day surgeon would be appalling. They laid broad foundations for the superstructure of surgery, which was to arise with amazing rapidity after the discovery of asepsis and anesthetics. Lister, by his revolutionary work on wound infection, and Morton, in the discovery of ether as an anesthetic, ushered in the era of modern surgery.

The debt we owe to Lord Lister cannot be overestimated. Before his discovery of the part played in inflammation and suppuration by living organisms, surgery was impossible, and hospitals were places dreaded and shunned by all mankind. Only those compelled by poverty or dire distress could be per-

suaded to enter their doors. Little wonder, for they were filled with the cries of agony, the moans of the dying, and the odors of putrifying flesh.

When Lister took charge of one of the great general hospitals of Glasgow in 1861, cleanliness played no part in the care of the sick and wounded. Suppuration erysipelas, and hospital gangrene were the rule. Thirty-five out of every hundred amputations were fatal; compound fractures were invariably infected. Surgeons themselves were less cleanly than the average person, because more accustomed to unpleasant odors and repulsive sights. They neither washed their hands nor cleansed the skin of their patients before operating. They hung their sutures upon the buttons of their coats, held their scalpels between their teeth and carried their bistories in the vest pocket. After opening an abscess or amputating a limb, the instrument would be wiped upon a dirty rag. It was the custom of Dr. Atlee, one of the early surgeons of this country, to use the same sponge over and over for laparotomies, simply washing out the blood under the hydrant and putting the sponge in his bag until needed for the next operation.

It is related of Sir Astley Cooper, surgeon to George IV, that on one occasion after doing a slight operation on the king, he was called to see him on the following day and noticed signs of displeasure in his royal patient. When he asked a friend what might be the cause of the displeasure it was suggested that the king might have been offended because Sir Astley's hands and shirt were spattered with blood! Infection was regarded as one of the mysteries of life, which only the will of God could change.

Lord Lister refused to accept the inevitability of wound infection and set about resolutely to find the cause and some way of combating it. He possessed the philosophic temperament and the unselfish devotion to science necessary to the accomplishment of these great ends. He first introduced rigid cleanliness

into his wards, but without avail. In his lectures to students he insisted that the formation of pus was not inevitable, but was due to some foreign substance introduced into wounds. It was not the air, but something conveyed by the air. In 1865 he read of the discovery of Pasteur, that "putrefaction was caused by living ferments," and he had the genius and the vision to see that the work of Pasteur and himself could be linked up into a rational explanation of the cause of infection in wounds. He now turned to the great task of making operations safe, and out of this has grown our modern aseptic surgery.

We have only to consider a few of the more important advancements in surgery since Lister's epoch-making discovery to realize how great was his service to humanity. Operations that were unthought of or considered impossible in the pre-antiseptic and pre-anesthetic day have become every day occurrences; and the mortality of surgical operations which once caused the boldest surgeons to quail has now been reduced to a negligible quantity. A comparison of the operations and surgical procedures practiced before the days of modern surgery with those of to-day graphically illustrates the strides we have made. Ligations, amputations, lithotomies, and treatment of fractures constituted the bulk of surgical practice prior to the nineteenth century.

The last twenty-five years comprise the golden age of surgery. The members of this Association have lived their active, professional careers in this glorious era of medicine and have played no small part in its conquests. During this period we have witnessed the successful invasion of one field of surgery after another, until now most of the great problems of surgery have been solved or are in process of solution. To-day we recognize as well-developed specialties surgery of the brain and nervous system, surgery of the blood vessels, surgery of the face and mouth, surgery of the thyroid gland, thoracic surgery, abdominal surgery, genito-urinary surgery, pelvic sur-

gery, and surgery of the joints and bones. The fundamental work in all of these specialties has been done by general surgeons.

To Pierre Broca and to Sir Victor Horsley, both general surgeons, belong the credit of laying the foundations of brain surgery in their studies on cerebral localization.

Blood-vessel surgery, including the modern treatment of aneurism, is chiefly the development of the last twenty-five years and is largely the achievement of American surgeons. Chief among these must be mentioned Carrel, Crile, Murphy, Matas, and Bernheim, all general surgeons.

To Theodor Kocher, one of the most versatile of modern surgeons, is due the credit for developing surgery of the thyroid gland. Notable contributions have been made by Drs. George W. Crile and Chas. H. Mayo.

Abdominal surgery has been the special field of the general surgeon ever since we learned that the peritoneal cavity could be safely invaded, and it alone of all surgical fields seems destined to remain firmly within our grasp. A host of general surgeons, too numerous to mention, have enriched this domain of surgery.

The first complete work in the English language on the surgery of the genito-urinary organs was published in 1851 by Dr. Samuel D. Gross, a noted general surgeon. He also was the father of orthopedic surgery, publishing a treatise upon the surgery of bones and joints in 1830.

It remained for Dr. John B. Murphy, the greatest general surgeon of modern times, to add the last brilliant chapter to bone surgery in his work on ankylosis, begun in 1901.

Thoracic surgery, the youngest of all the surgical

specialties, has also received its chief stimulus at the hands of the general surgeon. The thorax has heretofore been the almost exclusive domain of the internist, but now, through differential pressure methods, it has been rendered safely accessible to surgery. Our experiences during the great war have taught us that we need not fear acute pneumo-thorax, that we can open the chest widely, explore its contents as freely as those of the abdomen, and carry out successfully any surgical procedure indicated.

Notable contributions to chest surgery have been made in this country by Willy Meyer, Graham, Mozingo, and Hedblom; in England by Gask and Lockwood; in France by Duval and Tuffier; and in Germany by Sauerbruck. All of these are general surgeons.

Perhaps the greatest contribution that surgery has made to medicine is in the field of pathology. Before the days of routine surgery our knowledge of morbid anatomy was acquired at the post-mortem table. Lesions were studied in their terminal stages, and little was known of early changes in the tissues. The advent of modern surgery made possible the study of pathology in the living tissues and in the incipiency of disease. The surgeon was able to see and feel the abdominal structures. The internist, standing at his elbow, was permitted to observe the gross pathologic changes in the organs which he had studied clinically and to correlate them with the symptoms and signs elicited by physical examination. The physiologist was able to study the function of living organs and the pathologist to observe both the macroscopic and the microscopic changes in the early stages of disease. Empiricism and speculation gave way to living demonstration. To-day the average second-year medical student knows more of pathology than the most experienced surgeon of one hundred years ago.

But what of the future of the general surgeon? Is he to maintain his position of leadership in the devel-

opment of surgery or will he be compelled to surrender his laurels to the special surgeons, who are encroaching ever more and more upon his field? Most of the leaders in surgery to-day began their careers twenty-five or thirty years ago as general surgeons, when the whole field of surgery belonged to them. As new fields were opened, largely through the industry and research of general surgeons, they familiarized themselves with the technic of the various surgical specialties. These men were well grounded in the principles of surgery and easily acquired the technic of any new operation. Indeed, most of the surgeons of the generation that is now at its noontide are better qualified by temperament and training to perform operations now claimed by the specialists than are many of these same specialists. The supremacy of the specialist in his limited field has come about largely through special training in the use of diagnostic procedures and instruments of precision. His technical skill has often been acquired at the expense of that broader and more fundamental training which characterizes the skilled general surgeon. Nevertheless, by virtue of his skill in the use of diagnostic instruments, the specialist is claiming the right to treat surgically all of the lesions which his diagnostic acumen has discovered.

Thus it has come about that the field of the general surgeon is being constantly narrowed by the encroachment of the specialist. The neurological surgeon has largely preempted the surgery of the brain, spinal cord, and peripheral nerves; the oral and plastic surgeon claims the mouth, skin, and all of its appendages; the goiter specialist looks with disdain upon the general surgeon who essays to remove a thyroid gland; the thoracic surgeon just emerging from the common herd of general surgeons warns his former colleagues not to venture above the diaphragm; the genito-urinary surgeon, exalted by his skill in cystoscopy and functional diagnosis, has appropriated all of the organs lying behind the peritoneum, and occasionally while

doing a nephrectomy he sneaks into the peritoneal cavity and surreptitiously removes an appendix. The gynecologist, long since having laid claim to everything beneath the female pelvic brim, is now reaching up with greedy hands toward the appendix and intestines and even daring to grasp the gall-bladder through a suprapubic incision. Finally, the orthopedist, not satisfied with the correction of body deformities which we have graciously surrendered to him, is invading the most ancient and sacred domain of the general surgeon and is robbing us of our fractures. I have not mentioned the rectal specialist, the dermatological surgeon, or the beauty specialist.

In addition to all of these well-recognized surgical specialties which are invading the field of the general surgeon, we have also to compete with the radiologist, who has largely supplanted us in the treatment of fibroids and cancer and who bids fair to remove the tonsil and thyroid from the domain of surgery. We are left with only the upper abdomen as our undisputed surgical field, and even here the gastro-enterologist with his duodenal tube is threatening the gall-bladder, stomach, and duodenum.

What shall be the attitude of the general surgeon toward these encroachments upon his once undisputed domain? Shall he endeavor to regain the ancient boundaries of his craft, beat back the onslaught of specialism, and reassert his right to supervise the whole field of surgery? Or shall he forget his former glory, concentrate upon the narrow field still left, and himself become a specialist? Shall the general surgeon, along with the family physician, pass into oblivion?

It seems inevitable that the growth of specialism and the advancement of preventive medicine will greatly narrow the field of both the general practitioner and the general surgeon. Nevertheless, there will always be a place in the smaller centers of popu-

lation for men capable of covering the whole range of medical practice. In the great centers of population, specialism will flourish and become more and more restricted. There is grave danger that much of this specialism will rest upon a too narrow foundation. To be sure, it is no longer possible for any individual to cover the whole field of medicine, but the only safe basis for specialism is a comprehensive knowledge, both theoretical and practical, of the fundamentals. This cannot be acquired in the ordinary four-year course, even when supplemented by a hospital internship and a brief course of instruction in the chosen specialty. At least five years of general practice or the same period as first assistant to a master surgeon should be required of the man entering a surgical specialty. Even this rigid requirement would not be the equivalent of the hard school of experience through which most of the members of this Association have passed. Individual specialists, practicing independently, cannot furnish the coordinated effort necessary to cover the whole field of medicine. There must be some way found of correlating the knowledge and skill of the various specialists in such a way that the sick person will be viewed as a whole and receive suitable treatment in the most efficient and economical way. Society will ultimately demand that the best in medicine and surgery be made available for the average citizen. This demand should be anticipated and met by the medical profession. If we fail to do so, it will be forced upon us from without in the form of State medicine or political control. This need can only be met by some form of group practice. In this scheme of group practice, what shall be the role of the general surgeon? The field of diagnosis has been surrendered largely to the internist, and the surgeon has been content to stand in the relationship of mechanician to pilot, ready at any time, should things go wrong to repair the machinery, patch the blow-out, or clean the pipes. His chief interest has been centered in technic. There is no good reason why this should be so. Granting equal

reasoning power and fundamental training, the surgeon's dexterity, fineness of touch, and knowledge of living anatomy, both normal and pathologic, should especially qualify him in the field of diagnosis. In association with expert laboratory workers and men skilled in the use of diagnostic instruments, he should be able to compete with the internist in diagnostic work. The training necessary to qualify as a general surgeon is ideal for the field of diagnosis. The early recognition of disease and preventive measures are destined to comprise the bulk of future medical practice. It is possible for the far-seeing, thoroughly trained man entering the field of general surgery, to share with the internist the growing field of diagnosis and no longer be in the position of the repair man called in at the time of emergency. The distinction between general and surgical diagnosis is an artificial one and has arisen largely through the over-readiness of surgeons to find cause for operation. To the internist has been given the distinction of being more judicial and thorough in his diagnostic work and less influenced by personal considerations. The fees of surgery have no doubt had their influence in determining the decision of the surgeon, especially in the days when there were fewer aids to diagnosis. The short-cut to diagnosis was by means of exploratory operation; and, in the absence of our present refinements of diagnosis, the temptation was strong for the man possessing the skill and the courage to resort to direct action. There is little place in modern surgery for the exploratory incision, and its place must be taken by painstaking study and resort to all of the modern methods of diagnosis. The bold surgeon who ignores these newer sources of knowledge and operates for the fee is nearing his doom.

The general surgeon possessing qualities of leadership, familiar with all of the modern methods of diagnosis and well grounded in the principles of surgery, will find his field of future usefulness alongside the internist. These two, working in harmony and sup-

plementing each other, will act as a balance wheel for specialists and will vouchsafe to the public all of the benefits of a magnified general practitioner.

ACUTE OSTEOMYELITIS: REGENERATION OF THE ENTIRE SHAFT OF THE HUMERUS

Frank G. Nifong, M. D., F. A. C. S.

columbia, Missouri

The reason for presenting a single case-history of osteomyelitis is that some light may be thrown on bone pathology and the regeneration of bone. We have been accustomed to regard bone as an exceedingly complex tissue, differing very essentially in its reaction to inflammatory stimulus from other connective tissues. A closer study of bone infection and resulting inflammation will no doubt lead us to conclude that the processes of inflammation and the sequences thereof are practically the same as in other connective tissues. Either the multiple cellular destruction or the death en masse of bone follows the same course as do soft tissues after varying degrees of inflammation. These changes are only slightly modified because of the hard structure and the small difference in the blood circulation.

Bone cells, however, do seem to multiply and regenerate in very different degrees to the stimuli of different infections. Tuberculosis and carcinoma, for instance, produce a very slow destructive process, attenuating and rarefying the bone without rebuilding and regenerating. Syphilitic infection, on the other hand, produces a marked stimulus to bone cells, causing them to multiply and thicken bone. An acute infection of bone, such as acute osteomyelitis, will cause extensive destruction followed by a most active multiplication of osteoblasts and the quick regeneration

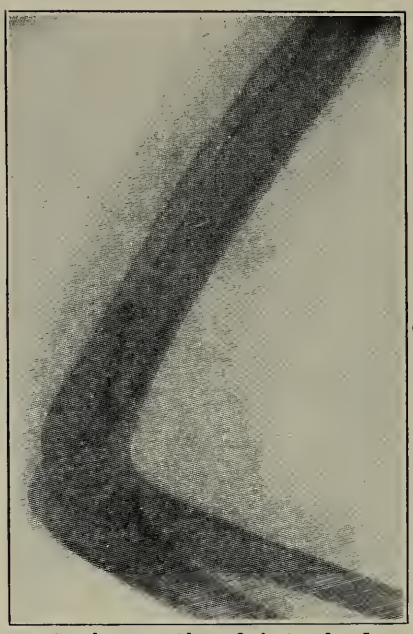


Fig. 1. This cut shows the faint shadow of the involucrum with the heavier shadow of the sequestrum taken before operation and about seven weeks after the onset of the disease. It is the lower end of the humerus and shows involvement quite down to the anticular end.

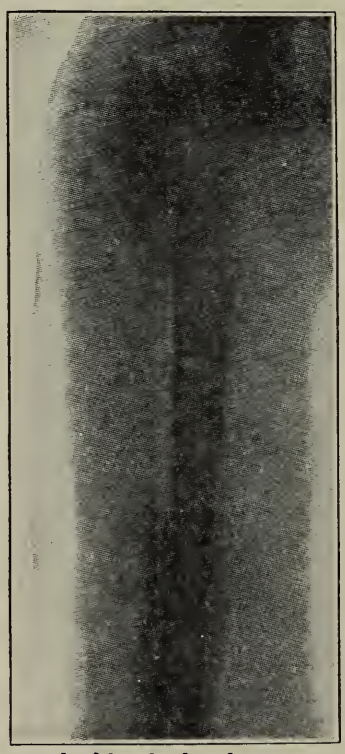


Fig. 2. The upper half of the humerus before operation and seven weeks after the onset of the disease. The involucrum and sequestrum show quite up to the anticular surface of the head. The rarefaction is sufficient for the shaft to be displaced inward on the head.

of the bone. These facts are curious and are not wholly analogous to soft-tissue inflammations from the same infections.

Some recent experimental work by Gallie and Robertson[1] seems to destroy our old notions of the osteogenetic functions of the periosteum. Their conclusions are that the periosteum is solely for the purpose of carrying the blood supply to the bone. It has no osteogenetic function other than that of supplying nutrition. We may produce sequestration by extensive destruction of the periosteum because of lack of nutrition, but periosteum can have no beneficial use in bone transplantation because its blood supply is cut off when moved. They explain that the subperiosteal osteoblasts, the active bone cells on the surface of bone and under the periosteum, are the cells which become active and multiply under inflammatory stimulus to make our new bone. Their experiments bear out the contention that periosteum has no effect in the transplantation of bone, but we cannot minimize its importance in the regeneration of bone even if we must give credit to the activity of the subperiosteal osteoblasts so closely associated with it.

The case we present you shows the wonderful capacity provided by nature for the building of new bone after an acute infection. We must in such a case account for our hematogenous infection, as we do in any other tissue or organ. Trauma may be an exciting cause with lowered resistance from disease or selective affinity. We have the blood supply through the periosteum and nutrient arteries, the classical picture of inflammation and the varying degrees of destruction. In this case we have an extensive destruction en masse followed by an exhibition of remarkable reconstruction. We have a removal of the sequestrum which was the entire shaft of the humerus. Only the articular surfaces of the ends were left with the periosteum or involucrum, which was the periosteum and barely palpable plaques of bone with it. From this we have the complete reformation of the humerus, and

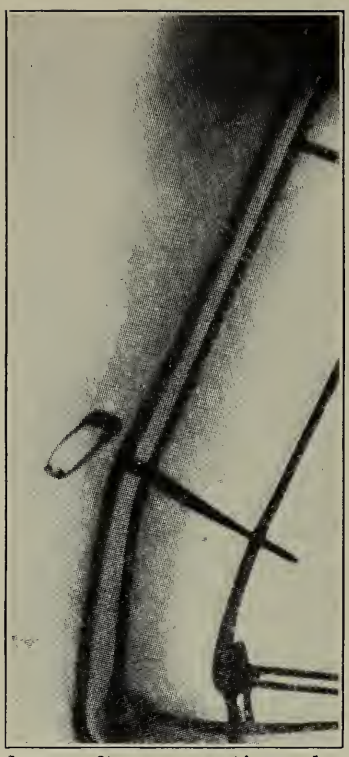


Fig. 3. Forty days after operation showing the absence of the entire shaft and only the nebulous beginning of bone-formation.

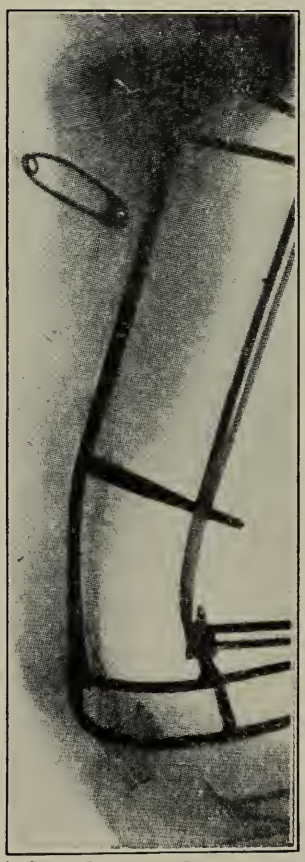


Fig. 4. Seventy-eight days after operation showing a distinct line of bone-formation.

nothing could demonstrate the importance of the periosteum and its function more clearly than this case. In forty days the *X*-ray shows only a nebulous shadow, but in another forty days a definite shaft line is visible.

We note the greater osteoblastic activity after acute infections, such as this acute osteomyelitis with great destruction of bone. May not this follow the law of nature in her efforts to repair any damage suffered anywhere in the human economy?

It is interesting to note also a question of clinical importance as to the bearing a sequestrum may have on the reparative process. In grafting bone, both autogenous and heterogenous, it is that the graft is gradually absorbed and new bone laid down by the osteoblasts, and every vestige of the graft is ultimately absorbed and replaced by new bone.[1]

The grafts appear to act as a nidus and assist in forming the new bone. The question, therefore, arises as to the value of the sequestrum in bone repair. Reasoning by analogy we should conclude that it is of great value in feeding these new osteoblasts in their work of making new bone. A clinical point, then, should arise as to the time when such sequestrum should be removed. Evidently, if the sequestrum is an aid to repair, it should not be removed too soon.

There is another matter of some clinical importance to be considered in such cases. Allison and Brooks,[2] by experimental and clinical studies, demonstrate bone atrophy and rarefaction from non-use. If functioning assists regeneration, conversely, of course, the lack of function will retard or inhibit it. A question of importance, therefore, in such a case as this is the time to remove the splint. In the case presented to you, the splint was removed as soon as we felt we dared to do it safely, which was about one hundred and forty days after operation. Then passive motion at the elbow and shoulder was begun, and, no doubt, this helped considerably in a fuller reconstruction.

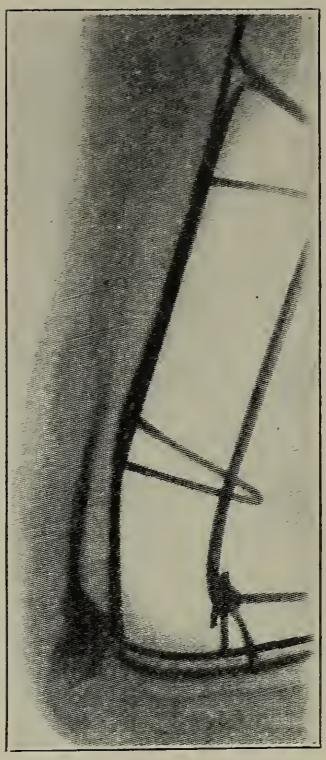


Fig. 5. One hundred and nine days after operation is shown definite bone-formation through the entire shaft of the humerus.

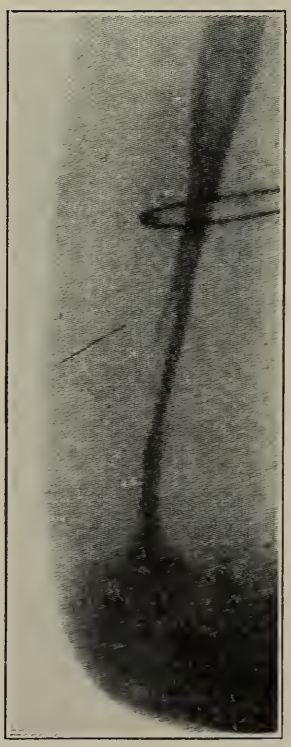


Fig. 6. One hundred thirty-nine days after operation enough substantial bone-formation has taken place and the splint has been removed.

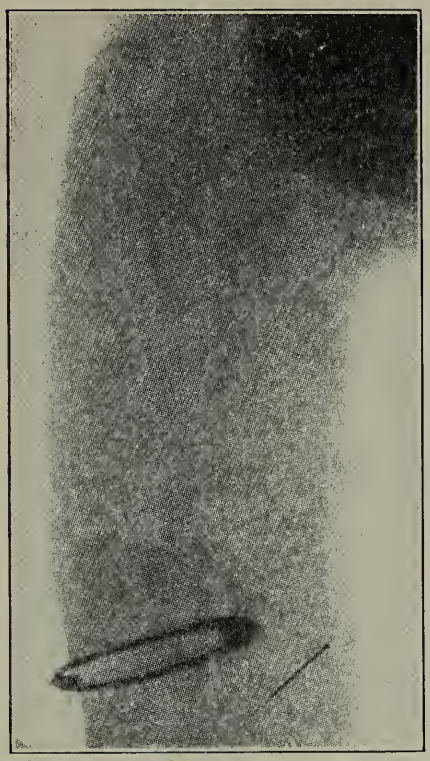


Fig. 7. One hundred thirty-nine days after operation. The upper end of the humerus showing substantial bone-formation, including the head of the humerus.

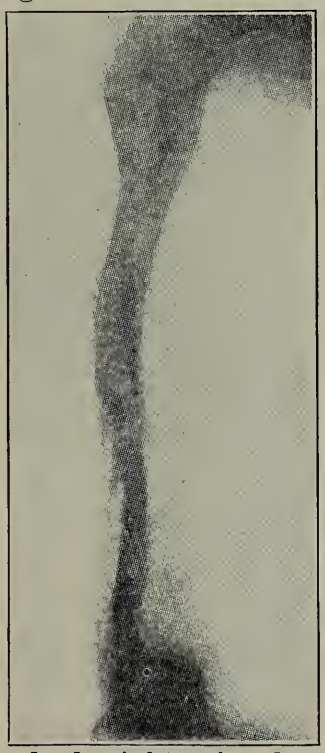


Fig. 8. One hundred eighty-six days after operation. Not a smooth but a substantial humerus.

Why do we not have an early diagnosis and expeditious treatment of acute osteomyelitis? It is a sad story and often a tragedy. The attendant very often fails to interpret the significance of the pain and we wait for all the cardinal signs of inflammation.

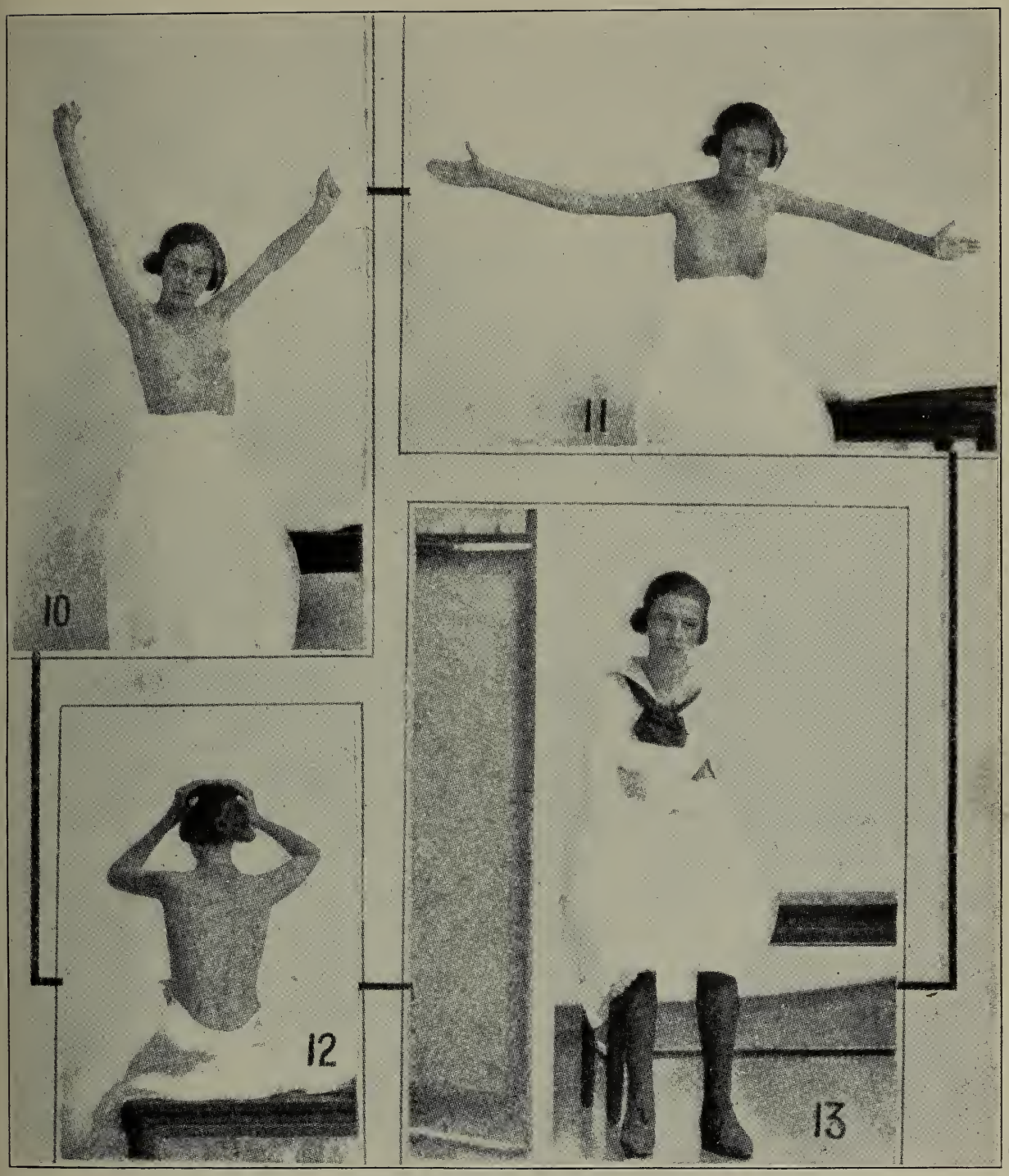
CASE-HISTORY

Reba Gladys Rippeto, aged 12; white; female; single; school-girl, Parker Memorial Hospital, July 15, 1919.

Family History: A healthy parentage, living brothers and sisters, and no hereditary stigmata. She has never had serious illness or injury. She has not begun to menstruate.

Fig. 9. Twenty-three months after operation showing the entire reconstructed humerus.

The present trouble began seven weeks ago with extremely severe pain in the left arm. There was no recollection of trauma, nor could any other probable cause be ascribed. The pain was of the deep throbbing kind, involving the entire left arm. There was not much noticeable swelling at first, but in five or six days a "pone," or swelling, was noticed on the front of the arm near the elbow-joint. This swelling continued to



Figs. 10 and 11. Twenty-three months after operation. These photographs were taken to indicate the amount of function obtained.

Figs. 12. and 13. Twenty-three months after operation. These photographs were taken to indicate the amount offunction regained.

enlarge extending up to the shoulder and she had much fever all the time. The family doctor was in attendance. At the end of the third week the doctor "lanced" the arm, and a great quantity of pus escaped. The fever subsided, and there has been but little rise of temperature since that time, and the patient has become much more comfortable. She has remained at home for four more weeks, and just now comes to our attention at the end of seven weeks.

She appears before us an extremely emaciated and pitiful looking little specimen of humanity, showing the deep ravages of the infection suffered. "Skin and bone" expresses the picture of her. Her heart and lungs were normal, as well as the kidneys. The left arm is still much swollen, with spastic muscles holding the forearm flexed at right angles. Two sinuses discharging pus were near the insertion of the deltoid muscle. X-ray plates were taken, which you will note in the pictures, one and two, on the screen. You will note the extra shadow enveloping almost uniformly the entire shaft of the humerus from the head to the elbow articulation.

Operation: Under ether anesthesia, an incision was made on the outer side of the biceps through the intermuscular plane long enough to reach the entire shaft of the humerus. The periosteal covering was split practically the entire length, and the sequestrum, which was the entire shaft, was removed except the articular ends, the cartilages. In this periosteum could be felt plaques of hard material, thin layers of subperiosteal bone. This split periosteum was sutured together. Very free drainage was instituted at both ends and the middle. The arm was left as flabby as any soft tissue, for the periosteal plaques were not enough as yet to make any stiffness whatever. The arm was placed in an improvised cradle made of fence wire, fashioned in the form of a triangle to permit ambulation and easy dressing. From this time on begins the long seige of dressings and after-care in an effort to increase her nutrition and capacity for repair. She responded gradually and, finally, satisfactorily. A series of x-ray pictures will indicate as graphically as anything could the final and most gratifying result.

Plates taken August 23, 1919, being 40 days after operation, show some shadowy nebulous formation, not promising as yet to make a humerus.

A plate taken October 1, 1919, shows more definitely

the lower articular end and the thin line of bone running toward the shoulder-joint. This is 78 days after operation.

A plate taken November 4, 1919, shows definite bone formation and a distinct shaft. This picture was taken 109 days after operation.

Plates taken December 4, 1919, or 30 days later and 139 days after operation, show the formed shaft still more distinctly, extending from one articular surface to the other.

A plate taken January 17, 1920, taken 180 days after operation, indicates how much repair and reconstruction may be made in six months.

You will note the absence of the splint in the December plates. The arm had stiffness enough to support itself without fear of breaking if carried in a sling. Passive motion at the shoulder and elbow was encouraged.

I did not see her again for some months, and a note on the case record dated September 1, 1920 shows that the arm was performing good, but not full function. Then we have no further record until June 18, 1921, 17 months later, and 23 months after operation, when she came to us and we secured plates and photographs of above date. They severally show the beautifully restored humerus and its articular surfaces, and the photographs will indicate the amount of function secured, which is not far short of normal.

She is now developing into a rather comely young woman of fourteen years, weighing 98 pounds, and is well nourished and healthy. The arm shows a large scar area on the front and outer side of the biceps. The measurements of the left arm are as follows: from the acromion to the external condyle; 9 inches; to the end of the olecranon, 9½ inches. From the right acromion to the external condyle, 11 inches; to the olecranon, 11½ inches, showing a difference of 2 inches. The right humerus plate is taken as a control.

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FOR DISCUSSION SEE PAGE 58

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PATHOLOGY OF OSTEOMYELITIS

With Special Reference to Growing Bone

Arthur C. Stokes, B. Sc., M. D., F. A. C. S.

OMAHA, NEBRASKA

Osteomyelitis is one of the most common and most damaging diseases of adolescence. Its morbidity, if not its mortality, is a factor in every community and the life accomplishment of these unfortunate individuals affected with this disease is often reduced to a mere fraction of its normal expectancy. Osteomyelitis once having become chronic is frequently a matter of years of suffering, repeated recurrence, and semi-invalidism, terminating by loss of limb or life. It is our hope that a careful consideration of its etiology and pathology may be of value in treatment and may reduce the inroads of this disease.

Osteomyelitis may be divided into, first, those cases of hematogenous origin and, second, those cases arising from infections. The form which is found in children from the ages of one year to eighteen years is hematogenous in origin, and the type to which we shall direct our attention in this discussion.

Osteomyelitis following gunshot wounds and compound fractures presents a different history, pathology, and course from that of the hematogenous form.

We have had the opportunity to study and treat 38 cases of osteomyelitis in the last two years, and we wish to submit a few observations as to the pathology in these cases. The average age of onset is in our cases ten years.

The number of cases of infection of the femur

was 12; tibia, 6; fibula, 1; humerus, 5; radius, 1; ulna, 1; pelvis, 4; tarsal bones, 4; skull, 2; clavicles, 2; phalanges, 2; and rib, 1.

There were 11 cases which had multiple lesions, and 27 cases had one lesion in one bone.

The acute first attack was observed 3 times. The chronic infection 35 times.

Trauma was given as an etiological factor in 18 cases. We were able to trace distant foci of infection in the body at the time of beginning 7 times. On the skin alone in the form of acne, boils, pimples, etc., 3 times. The distant origin of the infection did not appear 28 times.

Bacteriologically, we found staphylococcus aureus 12 times, staphylococcus albus 3 times, streptococcus 4 times, and various microörganisms 8, not noted 11 times.

We have not included tuberculosis, regarding its pathology as one quite apart and deserving of separate consideration. We have not observed a case of osteomyelitis due to typhoid bacillus nor one due to pneumococcus.

In Klemm's investigation he found 272 cases in lower extremities, 46 cases in upper extremities, 275 cases in long bones, 49 cases in flat bones, and 58 cases in spongy bones.

Many studies of osteomyelitis have been made from many angles, especially with reference to treatment. Experimental studies have been made by Rodet, Jaboulaye, Lannelongue, Achard, Lexer, Ulman, and Klemm; and clinical studies by Lexer, Nichols, Beck, Simms, Clopton, and others.

Hematogenous infection of bone occurs in individuals whose bones are not yet mature, and rarely occurs after that time. We must then look to the peculiarities of growing bone, in order to discuss with

accuracy and completeness the pathology of osteomyelitis.

In the young many of the tissues of the body have peculiar forms, which smack of previous function or change of function. Some of these changes are due to the organ losing its function,—that is, it becomes vestigial; and others, increasing its function,—that is, it becomes nascent. To the latter form belongs bone, because bone, as a support to the shape of the body and within the body, does not occur before the birds and vertebrates.

In the bone of children much lymphoid tissue is found, and its presence becomes an important factor in the etiology of this disease.

There are four areas of growing bone which are necessary to discuss, namely: (1) the metaphysis, (2) the cortex, (3) the medulla, (4) the periosteum.

The metaphysis is that portion of the bone adjacent to the epiphyseal cartilage and on the diaphyseal side of the same. In children and in long bones this is a very important factor in the growth of bone. It is in this region that the mucoid cells form red marrow. It is in this region that the red marrow, both in its embryonic state and in adult form, is most abundant; and in this area arise the oxygen-carrying corpuscles of the blood. This area is cancellous, the circulation is sinusoidal, the embryonic nature of the structure, especially in children, invites infection. It is in this portion of the bone probably that the leucocytes, carrying microörganisms through the blood stream, land with their burden and die. Is it any wonder then that the ends of bones in the growing period become infected? The cancellous portion is formed by the columnar cells of the cartilage extending and forming bony trabeculæ. These trabeculæ are constantly pushing the shaft before them, and within these spaces form the red marrow. Because of this growth the cortex of the bone and the medullary canal do not begin until the trabeculæ or col-

umns of bone end. In this area the trabeculæ are covered with no cortex, and only a very thin layer of bone separates the marrow spaces from the periosteum. This is particularly true of the upper end of the femur below the trochanter.

It is also somewhat more definite in the tibia than in the humerus or radius. If then, infection begins within the cancellous spaces of the metaphysis it may extend (a) directly out to the periosteum, (b) into the medullary canal, (c) into the shaft of the bone proper, or (d) through the epiphyseal cartilage into the joint. I have named these possibilities in order of occurrence.

The clinical symptoms and course of this disease are often determined by the location of the primary infection. At times no symptoms are produced before the infection is widespread, except a rise in temperature and possibly a chill. Local tenderness does not appear until pressure is produced upon the periosteum. This is generally early because the extension is generally within the metaphysis and toward the periosteum. Starr, of Toronto, called attention to this point in an article in 1919 before the American Orthopedic Association.

MEDULLARY CHARACTERISTICS OF GROWING BONE

Bone marrow retains, to a certain degree, its embryonic type until the bone is mature. The ratio of the embryonic marrow type to the mature marrow type decreases with age. Primitive or embryonic marrow, the type of tissue which is first found in the medullary cavities of bone in the developing fetus, is composed of mucoid cells, the branching processes of which form a delicate interlacing network, resembling that seen in any other mucoid tissue. This retiform tissue in the bones of the extremities becomes, according to Hammar, transformed into red or lymphoid marrow about the fourth month, the change being brought about by the immigration into

it of leucocytes from the blood stream. These wandering cells settle down and proliferate, giving rise to the lymphoid cells or myelocytes proper; while the branching cells of the primitive or embryonic marrow go to form the framework or reticulum of the fully formed tissue.

Red, lymphoid, or formative bone marrow is not found in any amount in adult long bones. It, however, persists even in adults in the flat bones, sternum, ribs, and vertebræ. Mature marrow—fatty or yellow marrow, as it is called—is composed of fat cells surrounded by a reticulum, the result of the development of the mucoid cells. This reticulum is connective tissue. Whatever may be the function of this bone marrow, as age advances the number of fat cells becomes less and less, and the connective tissue reticulum more and more until the bone marrow becomes what is termed fibroid in old age. If now the infection localizing in the sinusoidal spaces of the circulation of bone should extend first into the marrow, it has been proven again and again, and the experiments have been repeated by us, that the infection will travel the entire length of the bone marrow through the lymphoid spaces in a comparatively few hours. On account of the structures above referred to, young bone marrow offers much less resistance than old.

By the injection of staphylococcus aureus into the ends of a bone of young rabbits, we have been able to recover them in pure culture from the opposite end in forty-eight hours. So far as we have been able to judge, in our cases this rapid spreading of infection through the bone marrow is not accompanied by symptoms except a chill or a rise of temperature. After the infection has spread through the entire course of the bone marrow it will then choose some point in the cortex of the bone, which will be, of course, the point of least resistance, through which it will pass to the periosteum and will continue its damaging effects between the periosteum and the

bone, and may finally perforate the periosteum and become an abscess in the tissues, or it may dissect large portions of the periosteum off the shaft. Especially is this true in young bones and in cases where the perforation has been through a part of the shaft that is well developed.

The infection within the medullary cavity produces various results. It may leave local abscess; it may destroy the entire endosteum in which case the medullary cavity is finally filled with hard eburnated bone. It may extend to the opposite end of the bone and repeat the damage in the metaphysis of that end. It may produce localized areas resulting in Brodie's abscess and bone cysts, or it may produce the non-suppurating sclerosing osteomyelitis of Garre, or it may leave behind a sequestrum.

It is these different sequellæ of the bone-marrow infection which are responsible, in a great percentage of cases, for the chronicity and recurrent nature of this disease.

THE CORTEX OF GROWING BONE

The ossifying center of the bone diaphysis of long bones is usually near the middle point. The ossification extends out from the middle of the bone in the form of a convex surface, the thin edges being at the area of the metaphysis on each end of the bone. This point has already been noted and accounts for the fact that the perforations from within the bone are usually at or near the epiphyseal cartilage. The cortex, however, shows other peculiarities in structure, namely: growing bone contains numerous secondary cavities not of the Haversian type, but pure medullary areas. These medullary areas are filled usually with red marrow and contain arteries, veins, lymph channels so that often in early osteomyelitis the cortex of the bone is infected through the circulation, extending either from without, through the arteries extending into the bone in the canals of von Volkmann, or

from within, through the arteries extending into the cortex from the main nutrient artery of the bone.

One of the interesting features of the pathology of osteomyelitis is the fact that rarely does acute osteomyelitis perforate the cartilage at the epiphysis. It practically never does if the infection is a pure culture of the staphylococcus. If it also contains streptococcus it may, and does occasionally, perforate. This is due of course to the distribution of the arteries and the peculiar anatomical features of bone of which we have spoken. A second peculiarity of osteomyelitis is the fact that rarely is it accompanied by shortening of the length of the bone, provided there has been any form of rational treatment instituted; and when such a condition does occur it is a late result, and means neglected drainage of the bone.

The final end-results of osteomyelitis are sequestrum and involucrum, but it is not far to go from the facts which we have brought forth in order to show how certain areas of bone die. It is a purely circulatory matter.

SUMMARY

Growing bone has at least four histological differences from mature bone, which differences, no doubt, affect the fact that osteomyelitis occurs most frequently in ages under twenty years, namely:

1. Metaphysis, that is, the cancellous portion of the bone on the diaphyseal side of the epiphyseal cartilage which disappears at maturity of bone.

2. Medulla, which contains red marrow and yellow marrow with very small amounts of fibroid tissue well supplied by arteries, which arteries become fewer and fewer with age and the fibroid tissue of marrow becomes more and more and the embryonic elements less and less.

3. The cortex of young bone is embryonic in type, that is, its Haversian systems are not yet formed and in their position, and their forerunners are small medullary spaces which connect with the general arterial supply of bone.

4. The cortex at the growing area of bone, that is, the metaphysis is exceedingly thin and offers little resistance to the passage of infection to the periosteum. There is practically no cortex.

DISCUSSION OF THE TWO PRECEDING PAPERS

Dr. Arthur T. Mann, (Minneapolis, Minn.): There are only one or two points I want to make in connection with these papers. First, the question of whether or not periosteum produces bone is an academic one. There is a line of bone-forming cells which form bone, and if you put that in your definition of periosteum it does form bone, and if you put it out of your definition the periosteum does not form bone. This line of cells forms bone, and it is purely an academic question and a misunderstanding of terms.

In regard to the regeneration of bone: There have been a number of cases reported. I had one case of a tibia when I was very young in the practice of medicine and the point I noticed there was that, if we stuck a needle into the periosteum we found some grating of bone. The bone had already begun to form. This was our guide to determine that it was all right to take that shaft out. We saved the periosteum from one end of the tibia to the other, all infected bone, and pulled it out. In six weeks the bone was complete; the shaft of bone had become 50 per cent larger than before, not firm enough for the boy to walk on because it was not united at the epiphyseal line. The point where you will have the greatest trouble is at the epiphyseal line. In our case the disease ran up into the cartilage pretty well, and some of this was curetted. We established drainage at both ends, and it was three years before these bones were united firmly at the epiphyseal line, however, in six weeks the shaft had regenerated, and I think would have been strong enough to bear the weight of the boy provided the union had been firm at the epiphyseal line.

Dr. Kellogg Speed, (Chicago, Ill). Some eight years ago I resected the shafts of six long bones for acute osteomyelitis and found beautiful regeneration had occured.

The periosteum was opened, and the bone was entirely removed from epiphysis to epiphysis. Before the bone has necrosed, that becomes a questionable procedure surgically, and I merely cite the case to verify one or two points.

All young bone will regenerate from the Cambium layer of the periosteum, but you must conform with certain requirements to obtain the regeneration. The main requirements are two. The arm or the portion of anatomy that is involved must be put in extension, so that it is sightly greater in length than the fellow member on the other side. If the arm is allowed to shorten considerably, as in the humerus, you will never get a full length arm. You must extend it to full length. Secondly, if the periosteum is allowed to collapse or is sewn together, as recommended in the literature, you will practically never get regeneration of bone. You must keep the periosteum in a physiological position so that the bone will regenerate to fill up the cavity. This is done by distending the periosteum to its normal size by placing within it a non-adhering gutta-percha drain.

In Dr. Mann's case, the bone was 50 per cent larger than normal bone. Why? Because he stuffed the periosteum full of gauze drainage or some other material. If you take the adolescent child and treat it with these two requirements,—and we can do it best in children,—you can get the bone, in four to six weeks, to regenerate of such size as required. The humerus will regenerate completely in three or four weeks, and you have a new bone that will begin to function in a short time.

Dr. Nifong, (Closing): I have nothing more to say in regard to what Dr. Mann said. Of course, the function of the periosteum is important, and it seems to me that in laying it on the subperiosteal osteoblasts, and not on the periosteum, is rather begging the question.

These experiments were made to determine that the main function of the periosteum was blood supply, and the osteoblasts had to be there for regeneration to take place.

The point I wanted to bring up in the discussion was as to how much value was the sequestrum, and was it analogous to a bone-graft, and did it serve as a nidus in regenerating the bone. Apparently it is so, and clinically it is so.

On the other questions brought up there is nothing more to be said.

THE PATHOLOGY OF CARPAL BONE FRACTURE—DISLOCATIONS

Kellogg Speed, M. D., F. A. C. S.

CHICAGO, ILLINOIS

A study of the pathology of these lesions presupposes knowledge of the blood supply of the bones, of the occurrence, of relative frequency of the individual injuries, and of the causative mechanism of closed fracture-dislocations of the carpal bones. Some authors—notably Hirsh—claim that carpal bone lesions occur on an average of 2 to every 10 of the lower radial or the forearm fracture. As most instances of carpal injury are found in young adults, they nearly approach the frequency amongst that class. The relative frequency of the different lesions is (1) fracture of the navicular, (2) dislocation of the lunare, (3) fracture of the navicular, with dislocation of one or both fragments, (4) dislocation of the lunare and a fragment of fractured navicular, (5) fracture of the lunare and atypical and rare fractures or dislocations of the remaining carpal bones. One must also bear in mind the distribution of the synovial surfaces in the small carpal joints.

The blood supply of the carpus is derived from the volar and dorsal carpal network, small branches of the radial and ulnar arteries, which supply the articulations and bones of the wrist. Taking the navicular as an example, the sole blood supply for the bone and its periosteum arrives via the small branches of the carpal network, which find entrance into the bone, mostly about its middle where there are several minute nutrient foramina.

The causative mechanism is practically always, in closed fracture, a fall on the hand. The hand may be in a position of radial or ulnar flexion, and in extreme extension when the force of the fall is received on the palmar surface, or in full flexion when the force is received on the dorsum. The force of the fall on the palmar surface is transmitted through the middle and longest metacarpal on through the os capitatum to either the navicular or lunare, depending on the radial or ulnar flexion of the hand at that instant. This mechanism results in fracture of either bone by compression. If the hand is forced into hyperextension the ligaments uniting the proximal with the distal row of carpal bones rupture, and one or the other bone (sometimes both) escape compression, but slip out of place. Being still held by the attachment of the ligament to the radius, they come to lie out of place at a level below the rest of the carpus. This constitutes a palmar dislocation. When the fall is received on the dorsum of the hand, which is consequently forced into hyperflexion, one or both of the proximal row, navicular and lunare, may be similarly dislocated onto the dorsum of the hand and come to lie on a level above the rest of the carpus. This constitutes dorsal dislocation.

PATHOLOGY OF NAVICULAR FRACTURES

1. Trauma induces the fracture. The results are (a) fracture of the tuberosity, an extra-articular affair which heals readily and will not be discussed here, (b) fracture of the body, usually transverse, but may be complete or incomplete. The plane of fracture is narrow, and there is seldom much displacement of one fragment on the other, although one or both may be completely dislocated out of position. The condition is frequently unrecognized or inefficiently treated; it may be immobilized a short time and then moved, massaged and used vigorously.

2. The pathologic changes are (a) some traumatic

crushing of the spongiosa in the plane of fracture and its immediate vicinity, causing local loss of blood supply. (b.) disturbance of the vascular supply of the whole bone immediately after fracture. The nutrient vessels arriving via the periosteum and nutrient foramina along the ligamentous attachments are torn off.

This rupture involves especially the larger and important vessels near the middle of the bone. The bone so deprived of its blood supply, in areas remote from a remaining vicarious supply dies en masse. A thin layer on the surface of the fracture is bathed in and nourished by synovial fluid and serum just after fracture, which is intra-articular. There is edema in the bone. Some efforts at new bone formation begin rather remote from the fracture surface where the vicarious circulation keeps up nourishment (not true if the fragment is dislocated). At this point another clinical factor usually enters in view of non-recognition of the break, namely, motion and use of the wrist. Should a fracture be recognized within a short time and the wrist be immobilized we would expect bony union in a certain percentage of the patients. Such instances are recorded. However, motion and use generally are insisted upon early. These cause irritation of the fractured surface, interfere with efforts at new capillary construction, edema follows, and there is soon some smooth replacement of bone by fibrous tissue. Later lacunar absorption by giant-celled osteoclasts erodes away the bone surface of the spongiosa. There follows cavity formation, and this cavity is filled with a fatty appearing fibrous tissue which really contains no fat. The whole process is of course aseptic.

From observation in cases of atrophy of disuse in long bones we know that this fibrous filled bone cavity even when later treated by immobilization, rejuvenated circulation in the bone and every clinical chance for union, will persist. Bone trabeculæ in the spongiosa beyond the edge of the fibrous cavity may hypertrophy,

but they never make any attempt to penetrate into this fibrous tissue area to start filling the cavity with new bone formation. These points are backed by the study of two of our specimens, each removed five years after fracture.

The bone as a whole comes to be practically a foreign body in the wrist, causing painful restricted motion, leading to neighboring tendon fixation and ultimately to exostoses (arthritis deformans) of the neighboring bones. This involves the radius and is probably a natural attempt to stiffen the joint and prevent the pain from annoying the patient.

If we study a fractured navicular, taking first a fragment which was dislocated right at the time of fracture and removed within a few days by operation, on section it shows that it has sustained some tissue culture from the synovial fluid. This is demonstrated by the covering of normal cartilage, below which is a little normal bone, but beneath that the bone is all dead and the interspaces are filled with edema. The deeper bone, devoid of blood supply, fails to survive because the synovial fluid cannot penetrate to nourish it. We feel that we can say that after the fracture there was, first, interference with blood supply in the dislocated fragment. Some reaction of fibrous smooth replacement of bone followed, and later some lacunar absorption appeared. After these processes were well started, all blood supply must have been removed by secondary changes or pressure on remaining vessels, because all the bone died. All interspaces originally filled with marrow now were filled with homogeneous coagulated proteids.

A fragment of fractured navicular (the outer portion containing the tubercle), which remained in its normal position, shows on section normal live bone, normal fatty bone marrow. Some new bone formation is attempted, and there is some smooth fibrous replacement along the fracture plane. There are no giant cells and no lacunar absorption. Some areas

present sclerosis just beneath and extending to the fracture surface. We believe then that the microscopic evidence shows that the synovial fluid, instead of acting as an irritant (Codman & Chase), really acts as a tissue culture medium and keeps alive the edges of the dislocated fragment. The main reason dislocated fragments die after fracture is explained by loss of the blood supply. Hence, if a carpal bone or a part is dislocated out of position after fracture and lies out of position any length of time, these changes follow, and, if the bone were replaced, we could never expect bony union. In fact the replaced bone would probably act as a foreign body and induce further irritation in its neighborhood.

Consequently, we advise, after navicular fracture without dislocation of fragments immediate and prolonged immobilization of the wrist, looking toward a possible bony union of fragments. However, if the fracture has been neglected, if there is non-union of several weeks' duration or cavity formation, as after years of use, we know that an effort at bony union will never follow, so that, if the patient wishes relief from pain and any promise of improved function, excision of the whole bone is necessarily the procedure of choice.

PATHOLOGY OF LUNARE DISLOCATION.

Bone usually not fractured.

1. Trauma causing the dislocation causes the tearing away of a large part of the bone's ligamentous attachment, and the bone is displaced into a foreign position. The blood supply of the bone is seriously interfered with also, not so much at first except in that portion arriving via the now torn ligaments, which ceases at once.

2. At first there is considerable death of bone en masse. Some bone along the surface is nourished by the tissue culture action of the synovial fluid and the serum which pours around it. Also some portion of

the bone, that near any remaining normal blood supply, continues to live and may make an effort to supply the rest of the bone with blood. Soon there follows a small effort at bone regeneration. Later at the points where ligaments have been torn off, there ensues a smooth replacement of bone by fibrous tissue. The new and unnatural position of the bone causes edema, the remaining normal blood is very soon cut off (in a few days), and there is further death of bone. After some weeks the smooth absorption of bone at the points mentioned is aided by lacunar absorption by giant-celled osteoclasts. Consequently, a whole lunare bone dislocated out of position and left there for several months, which has been subjected to use and trauma, when removed by operation, has a rather worm-eaten appearance and has lost much of its spongy bone. This is verified by the x-ray examination, which shows the irregular reduction in bone density from absorption of the calcium salts.

We believe, therefore, that a dislocated carpal bone replaced within a short time after dislocation, might renew its vascular connections and continue to live. When it has remained out of place for some time (a week or more), if returned to its former position, the changes indicated have been inaugurated, new blood supply, which will doubtfully follow, will not compensate for smooth replacement and lacunar absorption, and the bone, probably, will lie in the wrist as an irritating foreign body.

Displaced (dislocated) fragments after fracture, as of the navicular, if returned promply to position and treated by immobilization, may unite. This is very doubtful. If they are displaced long enough to undergo the changes described and then return in contact with the remaining undislocated fragment of the bone union will never follow. The cavity from which any dislocated fragment is extruded tends to shrink rapidly and to become filled with fibrous tissue. It is quite impossible to return the bones to these shrunk-

en areas; and it is undesirable to do so because neighboring bones must not be damaged.

When one or both bones in the proximal carpal row are removed, the loss is seldom noticed physiologically. If the bone has acted as an irritant, the loss by removal results in a functional improvement. When both bones of the proximal row, dislocated, are removed early, the functional result is excellent. The loss is compensated for by an approximation of the distal row, by new adventitious ligaments, and a compensatory shortening of all finger tendons, so that function is excellent.

DISCUSSION

Dr. William Hessert, (Chicago, Ill.): There are a few points that might be especially emphasized relative to this paper. The first general statement that should be made is that many obscure injuries of the wrist joint have been cleared up by the x-ray, acute and chronic conditions that previously went unrecognized and have been found to be fractures or dislocations of the carpal bones.

Again, of injuries to the carpal bones the majority of cases are found in the scaphoid and semilunar. The semilunar is the one most frequently fractured, and the scaphoid the most frequently dislocated, although dislocations occur of both the scaphoid and the semilunar. In this connection I might refer to a case, a report of which I published in the Annals of Surgery ten or twelve years ago in which both scaphoid and semilunar were dislocated and removed. I have had occasion to follow out the course of that patient's convalescence for years. He made a good recovery. He is a painter by occupation, and the loss of function is less than ten per cent. In other words, when it comes to treatment—and that is an important feature—the discussion is more apt to be academic of what should be done in these cases of fractures and dislocations of the carpal bones.

In the first place, in regard to the treatment of dislocations of the semilunar, it is my personal conviction that removal is the only treatment. Personally, I have never succeeded in replacing a displaced semilunar. Possibly some of you have, but it has never been my good fortune to get the semilunar back into place, even though

the patient was seen early. I have tried to get it back, but have never succeeded, and in all cases where I have followed the treatment of removing the bone there has been very little disturbance of function, much less than when the bone is left in place. Whether it would be as radical as that in the treatment of fractures I shall not say, although we know by experience that in young patients with fracture of the scaphoid, unless the bone is removed, in the majority of cases they will have a disabled wrist for years; they will never get well because a fracture of the scaphoid frequently will not heal, so that in most of these cases I believe that after the scaphoid has been given a reasonable time to unite and does not do so after a couple of months it ought to be removed. To summarize, I would say the removal of these bones when dislocated is the best thing to do for the reason that impairment of function is very little.

Dr. Vernon C. David, (Chicago, Ill): I would like to emphasize the importance of recognition of these fractures of the carpal bones by the x-ray. While the great majority of them are visible by the x-ray, we have an exception. A fracture of the scaphoid, with disability of the wrist, in being x-rayed and compared with the well wrist in both anteroposterior and lateral views, did not show fracture, the disability of the wrist continuing for three or four weeks. When another skiagram was taken not only was fracture present, but displacement of the fractured bone was seen. I think it is a point well to remember, because it leads, not only to mistakes in treatment, but also to mistakes in prognosis.

Dr. John L. Porter, (Chicago, Ill.): There is one feature I wish to accentuate in the treatment of fractures of the carpal bones,—regardless of whether operation is done or not and regardless of whether the carpal bones are displaced or not; and that is that the wrist should be dressed in extension. The flexion of the fingers depends largely upon the ability to extend the wrist; and, no matter whether the wrist is operated on or not, unless the hand can be brought up into full extension the resulting disability in the hand will be greater and function will be disappointing.

Dr. Roger T. Vaughan, (Chicago, Ill.): I should like to call the attention to the fact that the scaphoid bone may arise from two centers and be bipartite. This anatomic variation was called to my attention first by my radiologist friends. I saw the radiograph of such a case this week. The patient came to the hospital with recent

trauma of the wrist. The radiograph showed the scaphoid in two parts, both smooth, without any fragments. The patient himself gave no history of ancient trauma, which might have produced that lesion. The recent trauma produced a fresh Colles' fracture of the usual type. The opposite wrist, unfortunately, was not radiographed for purposes of comparison.

Dr. Speed, (closing): I had no time to go into all these points. Bipartite bone of the wrist has been known since 1834. Dr. Hessert, I think, made a mistake. The relation of fractures and dislocations may have occurred in his practice as he gave it, but all statistics show that fractures of the scaphoid are by far the most common, and second, dislocations of the lunate and so on down in their order. I did not have time to enumerate all these things.

The whole purpose of this study is that we try to apply the pathology to treatment. If the scaphoid or any other of these bones is fractured and lies for some time deprived of circulation, it will undergo a minimum attempt at repair if the wrist is moved. If the wrist is immobilized immediately—and some cases so treated have been reported that are very authentic—the bone will acquire bony union; but in most of the cases that are not recognized, massage of the wrist is instituted, and, if repair does not take place, there is nothing ultimately to do but to take out the bone. If the bone is dislocated out of position you will find the same process goes on, and if it lies out of position very long, say, more than one week, it is inexcusable and inadvisable to replace the bone and expect it to link itself up with the circulation and go on living normally. It will act as a sequestrum, and it will promote exostoses and arthritis deformans in that joint.

THE LESSER INJURIES TO THE BACK AND THEIR INDUSTRIAL SIGNIFICANCE

Oliver J. Fay, M. D., F. A. C. S.

DES MOINES, IOWA

The rapid development of compensation laws and compensation service has been due, in large measure, to the co-operation and earnest endeavor of the medical profession, but medical science, in turn, has been markedly influenced by the development of compensation. Industrial medicine has put a premium upon accurate observation, and has demanded that prognosis be considered something more than a game of chance, that it be given a firm scientific basis. Injuries of the back, aside from crushing and dislocation of vertebræ, have proven particularly difficult problems from the compensation standpoint, and the more accurate study which they have accordingly demanded has done much to clarify our knowledge of these lesser injuries of the spine.

Fractures of the spinous processes are numbered among the traumatic lesions whose industrial significance far overshadow their anatomical importance. Before the day of the universal employment of the *x*-ray in all injury cases in which bony lesions are at all probable, fractures of the spinous processes were given scant attention. A large percentage of them were grouped under the convenient head of traumatic lumbago, while a lesser number were elevated to the dignity of fracture of a vertebra. Such diagnoses were in part based upon the varied type of force producing the injury. In those cases in which muscular exertion was the causative factor, the preference was

for a diagnosis of lumbago or sprain; where direct violence was responsible for the injury, particularly where more than one spinous process was involved, fracture of the vertebræ seemed the logical diagnosis. To the subjective symptoms of pain on motion and localized tenderness and to the objective symptoms of crepitus and palpation of the movable fragment (both may be lacking because the fracture is often incomplete), we now have the precise information given by the *x*-ray. In early cases the *x*-ray reveals the line of fracture, always granted that your picture is clear and that you are thoroughly familiar with the röntgenography of the normal back, while in later cases the bulkier shadow of the callus should clear the diagnosis. The treatment, as in all fractures, is immobilization, and this may usually be secured by adhesive strapping. If several spinous processes are involved or muscle tension is great, a light cast may be advisable.

From the standpoint of cause, diagnosis, and treatment, these fractures of the spinous processes would seem an elementary lesson in surgery, but the number of such injuries that have come to me for compensation adjudication have destroyed my faith in the simplicity of the problem. These injuries are simple fractures of small bones and as such should heal in the same time as fractures of bones of about the same size in other parts of the body, say, of fractures of the fingers. Yet many workmen who on this basis should have been back at work in from four to six weeks, come up for examination after as many months of idleness. These delayed cases may be roughly divided into two groups: those whose injury has been exaggerated, and those whose injury has been overlooked or minimized. The first group is made up of men who are under the impression that they have sustained a serious injury to the spine. I have been struck, by the way, by the number of such patients who have been under the care of an osteopath or chiropractor. Others have gained the same impression

from the application of a cast or from the well-meant but ill-advised statement of the surgeon, that one of the bones of the back has been broken. In the second group are those cases in which the fracture has been overlooked,—the diagnosis of lumbago is an easy but often a pernicious one,—and the normally short period of healing has been much prolonged by lack of proper treatment. In most of these cases the men eventually return to work after an absence of some months, instead of some weeks; but in an occasional such case removal of the detached and troublesome spinous process becomes necessary. From the standpoint of industrial psychology, these cases of delayed healing are often peculiarly unfortunate; the insurance company feels that the laborer is a malingerer, and the injured man that he has been given inadequate attention and unfair treatment.

Fractures of the transverse processes result from indirect violence, but the determining accident may be trivial or severe. The symptoms are essentially those of fractures of a spinous process. Crepitus, however, can rarely be elicited because of their inaccessible position, and differential diagnosis was almost impossible before the employment of the *x*-ray. The spinous processes most frequently fractured are those of the thoracic vertebræ, occasionally only those of the cervical or lumbar region; fractures of the transverse processes almost invariably involve the lumbar vertebræ. Pain is, on the whole, a much more marked feature of fractures of the transverse than of the spinous processes. It often radiates to the extremities, the groin, the coccyx, the anterior abdominal wall, and in the absence of an *x*-ray examination, has led, not only to the familiar diagnosis of lumbago, but also to the diagnosis of appendicitis and of ruptured kidney.

When the diagnosis is made early, and immobilization is secured by a fortnight's rest in bed and a cast, or even by adhesive straps, such fractures usually heal within a month. Even in the occasional case in which

an ununited fragment or a large callus calls for surgical removal, the period of disability should not be prolonged beyond a few months. But in those cases which have escaped early recognition, and have received more or less attention than the character of the injury required, the story of mismanaged fractures of the spinous process is repeated in an aggravated form. Not only may the disability due to pain on flexion and rotation of the spine be indefinitely prolonged, but partial permanent disability within the meaning of the compensation law may result where the postural scoliosis, produced by involuntary muscular rigidity or by the patient's voluntary attempt to assume a comfortable position, may become permanent.

Fracture of the arch is a connecting link between the lesser and the graver injuries of the spine. Where the fracture is bilateral, as it so often is, displacement of the fragment may result in grave injury to the cord, and the injury then receives something of the rank of a fracture of the vertebral body. But unilateral fracture of the arch also occurs, and probably more frequently than we suspect, for diagnosis, even with the aid of the *x*-ray, is often difficult. A unilateral fracture of the arch without displacement or cord injury heals rapidly when immobilization has been secured, and disability should not extend beyond a few weeks.

Under sprains of the spine we group many cases of injury to the spine in which we are forced to reason from an indefinite etiology or mechanism. In sprains the radiographic study of the spinal column is negative, but, following a fall upon the head or back, the direct application of force, or even forced lifting, we encounter the symptoms made familiar by "sprains" of other joints. (I am again ruling out those cases in which there are more than transient symptoms of cord injury.) The exact pathology can only be surmised: overstretching and torsion of ligaments, lacerations or contusions of ligaments or capsules, for the

mechanism of a sprain is essentially that of an incomplete or transient dislocation. Sprains, like dislocations, are most common in the cervical region where the range of motion is the widest, occasionally occur in the lumbar region, and are rarely met with in the dorsal region.

Here, again, immobilization is to be secured by the application of a cast or, in mild cases, by adhesive strapping, and rest in bed. Prognosis is notoriously unsafe in any case of sprain, since the extent of damage to ligaments and cartilages can only be conjectured, and both structures heal slowly. But the universal recommendation for a guarded prognosis cannot be given unqualified endorsement, for a prognosis may be so "guarded" as to pave the way for the development of a compensation neurosis, and so be more productive of injury to both patient and industry than was the original accident. The sprain which is little more than sore muscles may heal within a few days, and even in case of the most serious injury to which the term sprain may properly be applied, i. e., torn ligaments or cartilage, three months is usually amply sufficient for recovery. In no case of sprain should disability extend beyond six months.

The diagnosis of contusions of the vertebræ, like that of sprains, has a rather uncertain basis, in that the pathology can rarely be demonstrated, and diagnosis is reached by a process of elimination. If, following a fall upon the head, back, or buttocks, there is pain on motion, as evidenced by muscular rigidity, and pain on pressure over the given area, when fracture of a vertebra has been ruled out and the diagnosis sprain is found hardly applicable, we may speak of contusions of the vertebræ. While sprains usually occur in the cervical region, contusions of the lumbar vertebræ are most common. There is often no physical evidence of sprains, but ecchymoses and extensive bruising of the overlying soft parts are often associated with contused vertebræ. Slight irregularities of the

margins of the vertebræ may be demonstrable by the *x*-ray. Rest in bed and immobilization by strapping, occasionally by a light cast, bring immediate relief and early recovery. Disability should rarely extend beyond a period of four to six weeks.

The number of cases of traumatic lumbago decreases in direct ratio to the care with which the lesser injuries of the back are classified according to the actual pathology. The term "lumbago" is here used to designate those cases in which a sudden, severe pain in the back follows unusual or excessive exertion. Since the nature of the accident makes actual injury to the vertebræ extremely improbable, we assume that injury to muscle or nerve fibers is responsible for the pain, and, for want of a more specific term, we speak of *traumatic lumbago.* In industrial medicine the expression is not a fortunate one, for in a majority of cases the incriminated accident has been too slight to warrant the application of the term "accident" within the meaning of the law, that is, there has been no unusual or excessive muscular effort required. The onset of pain in any case of so-called lumbago is characteristically sudden, so that the term *traumatic* should be applied only to those cases in which the onset of pain was immediately preceded by some unusual exertion, such as the lifting of an excessive weight or by external violence. Muscular rigidity is evidence that the area is painful, and recovery within a few days is further confirmation of the diagnosis. Strapping the back, the application of heat, the use of salicylates, bring relief and perhaps hurry the early recovery.

Accurate diagnosis and adequate therapy materially lessen the period of disability in these lesser injuries of the back, but a clearer understanding of the character of such injuries and their prognosis is even more essential if we are successfully to combat the increasing number of cases of compensation neuroses. It is not my purpose to discuss the various psychic theories of the pathogenesis of traumatic neurosis,

nor to consider the relative merits of the various terms used to designate that condition,—"railroad spine," hysteria, traumatic neurasthenia, traumatic neurosis, hysteroneurasthenia, or neurasthenohysteria, call it what you will. But any discussion of back injuries would be incomplete without some mention of the prevention and of the cure of this disastrous complication. To the average layman there is a sinister suggestion in any injury to the spine, however trivial, and any fracture suggests a broken back. If he is addicted to osteopathy, the idea that he has a misplaced or "subluxated" vertebra may ordinarily give him only a pleasurably morbid thrill and the osteopath another source of revenue, but, if an accident precedes the discovery, the tale is a very different one. He is immediately obscessed with the idea that he has something at least akin to a broken back, and that his compensation should be scaled to accord with his great disability. Sometimes the medical practitioner produces the same effect, unintentionally in most cases, I believe, when he speaks of a fractured spinous or transverse process as a fracture of the spine. Here, too, the injured man is too apt to gain the impression of a "broken back," and it is with difficulty that he is returned to the ranks of the workers, and then in an antagonistic and resentful frame of mind.

I believe that prevention is far better than treatment, and that prevention is possible in a large percentage of these cases if accurate prognosis is made possible by careful diagnosis. If the injured man realizes from the first that his injury is a minor one and that his disability will not extend beyond a given brief period, he is often ready to return to work before the expiration of that period. Where disability extends beyond the anticipated term, a painstaking examination should be made to exclude the possibility of an error in diagnosis, and also that of willful malingering. In the latter connection, it should be remembered that unilateral muscular rigidity cannot be counterfeited; that anesthesia or tenderness to

pressure which does not recognize anatomical limitations, is neurasthenic or spurious; that the malingering or neurotic patient who finds it impossible to perform certain motions without evidencing dire distress, can often be induced to employ the same muscle groups without any expression of discomfort if he does not recognize the significance of the test.

Once the diagnosis of traumatic neurosis has been made there is only one effective treatment,—definite determination of the period of disability. Examination and reexamination, fixing and refixing a period of temporary disability is as sane a treatment as repeated partial excision of a maligant growth—such treatment only stimulates the disease. The patient will recover from his neurosis when the irritating element of gain is irrevocably removed from the etiological complex, and only then. Fix a definite limit to the period of disability, and you have also definitely determined the date of recovery. The auguries of the ancients had, without doubt, a therapeutic effect, as well as a religious significance.

DISCUSSION

Dr. John L. Porter, (Chicago, Ill): The subject which Dr. Fay has chosen is such a large and important one that it is well worthy of a symposium. I could suggest nothing that would be more worth while than half a day given to the traumatisms of the spine. Dr. Fay has stated the facts and has given us a most admirable paper.

I wish to applaud what he said regarding our unfortunate use of the term "traumatic lumbago." I believe we should be able clinically to differentiate between fractures of the spine or any parts of the vertebræ and ruptures of the spinal ligaments. In my experience fractures of any part of the vertebræ produce immediate disability. Dr. Fay touched almost too lightly upon the subject of fractures of the articular processes. The patient knows at once he has an injury sufficient to interfere with going on with his duties, and the pain is severe. But we do have ruptures of the ligaments, and especially about the lower spine,—ruptures of the sacrolumbar and iliolumbar ligaments, which are only temporarily disabling.

I have in mind a case I might recite. The patient was a physician who sustained a slight injury to the back. For a moment or two the pain was severe. It rapidly passed off, and in the course of fifteen or twenty minutes he was able to go on with his duties. The next day his disability was so much greater that he was almost unable to move. If we follow the chronological sequence of events with rupture of the ligaments, great pain and disability do not appear until an exudate has taken place in and around the area injured, while a fracture of any part of the bone is almost sure to be immediately disabling. With compression fractures of the bodies of the vertebræ in which the patient may be temporarily disabled, he may go back to his work the next day although an *x*-ray picture will show evidences of compressed fracture. If it goes on without treatment his disability grows steadily greater and greater.

I want to make a plea for the immobilization of all spinal injuries. You cannot make a mistake in a fracture of the spine by immobilizing it, because these patients who have had injuries of the vertabræ and compression fractures, or rupture of the ligaments, if they are not immobilized and given a chance to get well, become chronically disabled, and some of them come back two or three years after the injury, never having had a diagnosis made possibly, and unable to work.

We are justified in completely immoblizing with plaster of Paris every injury to the spine because it hastens the period of recovery.

Dr. Samuel C. Plummer, (Chicago, Ill): I would like to speak of two points in connection with this paper. First, I like the thought of the paper because it is a very important one. One point is the matter of the *x*-ray and the danger of having an *x*-ray picture that is not the best. I believe that many of these fractures can be found only by an expert operator who has the very best of apparatus. Among other essentials are the Bucky diaphragm. A good skiagram of the spine of a heavy person and of the lower lumbar region is especially hard to get. I have seen quite a number of cases where skiagrams have been taken by radiographers of average experience and with an average good apparatus, and no injury found, and then, when another skiagram was taken by one of the best radiographers with the best apparatus, an injury or fracture was found. I call attention to the difficulty of getting good skiagrams of the spine on which we can rely.

Another point is the frequency with which in older

patients these good skiagrams show the presence of chronic osteo-arthritis. In these cases a slight injury to the spine will light up and exaggerate the existing trouble, and the injury is given credit for the existing disability, part of which is due to the underlying pre-existing trouble. It is hard to draw the line between how much is due to the pre-existing osteo-arthritis and how much can be attributed to the injury the patient has received

Dr. William Jepson, (Sioux City, Iowa): There is one point I would like to bring out in connection with this admirable paper, and that is a thought that has occurred to me, and I think I have a basis for it, namely, that we often say too much to our patients about their injured backs, with the result that much of the difficulty of which they complain is of their own conjuring up. In support of this view, I want to say that during the late war it was my misfortune, or fortune, to be in charge of the surgical service of a base hospital, and it amounted to about four aviation fields in consequence of the number of aviators that were injured during the war. I was surprised at the number of fractures that showed up among those boys. I have reference to fractures of the bodies of the vertabræ, of the spinous processes, or of the transverse processes. But, as a rule, they were always associated with some other fracture, with the reresult that these boys were confined to bed. They had cause to be on their backs, while a number of them were confined to bed on account of other injuries, rather than injuries of the spine. I recall one aeroplane that came down, and both men in it suffered from fractures of their backs, yet those boys in the course of eight or nine weeks were up and around, and they did not seem to complain about their backs at all. They did not know there was anything wrong about their backs. I am quite sure, had they known they had a fractured back, it would have been a great deal harder to get along with them than it was under the circumstances. In these instances their attention was fixed on other injuries,—broken legs, broken jaws, etc., and their backs were overlooked.

Dr. M. L. Harris, (Chicago, Ill.): I want to call attention to the necessity in taking x-ray pictures of the back to take them in two directions in a supposed fracture of the body of a vertebræ. Slight compression fractures of the body often cannot be detected by the anteroposterior ray, but may readily be detected by a picture taken in a transverse direction. A diagnosis not based on pictures taken in two directions is unre-

liable and unsafe. Likewise some fractures of the spinous processes cannot be seen in an anteroposterior picture, but are readily visible in a picture taken transversely.

To recapitulate: In these injuries one should always have pictures of the spine taken in two directions. In the second place, I think strapping of the back is a delusion and a snare. I do not think it amounts to anything as a means of immobilization in a real injury. It may give the patient the idea that he has been immobilized when he has not been, and may lead him to think that something has been done. If the back needs perfect immobilization, as in injuries of the spine, I think we should eliminate strapping of the back. If there is no real injury, and strapping is done as a placebo to satisfy the patient—that is another thing, but as a real means of treatment it is of no value whatever.

I would take exception to one point brought out by the essayist in regard to fractures of the transverse processes. He said that fractures of the transverse processes ought to be well in a fortnight, or that they would heal and be well in that length of time. If there is any fracture that needs a long time, it is a fracture of the spine, in any part of it.

Dr. William T. Reynolds, (Kansas City, Mo.): I believe I would be false to the faith if I did not emphasize one point in Dr. Fay's paper, and that is, where the osteopath enters into the treatment of injuries of the back. I can do this in no better way than briefly to outline an experience of a few months ago. A man in Western Kansas got in a mixup with a team of mules hitched to a farm implement which they pulled over, catching him in such a way that he sustained a fracture of the twelfth dorsal and first lumbar. There was evidently at this time no displacement. His physisian put him to bed and explained to him that he might have a fractured back, but as there was no evidence of paralysis there evidently was no pressure on the cord. On the third or fourth day he was suffering some pain and was coaxed into calling an osteopath. This enterprising osteopath had made a diagnosis long before he reached the bedside. He said, "Sure, you have lumbago, and we will fix you right up." He took him by the heels, gave him a violent doubling up, and instantly the man remarked, I have no feeling in my legs." In a few hours he did not have bladder function.

I mention this case merely to show that we are a little derelict in our duty when we do not give such incidents

wide publicity. These people are hurting patients: and they are creeping into legal matters and deserve a wide amount of publicity in regard to their mistreatment of injuries of the back.

Dr. Clarence W. Hopkins, (Chicago, Ill.): I was very much surprised to hear a very prominent surgeon of Chicago, in discussing fractures of the spine, particularly compression fractures of the vertebral bodies, state that as a rule, he allowed these patients to be up and about and to sit in a chair after a week or ten days.

When we consider the extent of injury to the vertebral body after undergoing a marked compression, and remember that there is a period of absorption and rebuilding which has to take place before the spine is able to normally support the weight of the body in the erect position, I think we can all readily understand why it is necessary for a patient with an injury of this kind to be kept flat on his back for a number of weeks to allow the process of breaking down, absorption, and rebuilding to take place, after which it is necessary to apply a plaster cast and later a leather and steel corset to maintain the upright position.

In the last three years I have had twenty-six compression fractures of the vertebral bodies under my care in all of which cases the patients were kept upon their backs from three to four months on a hard flat bed or upon a Bradford frame, to correct any kyphosis that might take place; and I have then applied a plaster cast which they have worn for several weeks while a leather and steel brace was being made from a model, which I had them wear up to the end of a year from the date of injury before I felt safe in allowing them to go without such a support. With the exception of the patients under my care at the present time, all of these people have gone back to their regular occupation in good condition with the exception of two, who sustained a division of the cord and later died.

In addition to the patients I have just mentioned I have had several come under my care during that time in whom the diagnosis of compression fracture of the vertebral body had not been made, and who were allowed to be up and around too soon, and in whom I found a permanent deformity with inability to hold themselves upright without an abnormal muscle-pull, and who are still suffering from painful backs.

I feel that sufficient attention was not given to a great many of these cases, and a diagnosis had not been made

due to the fact that proper lateral *x*-ray plates were not made, the cases having been diagnosed as sprained backs, due to the fact that the anteroposterior plates did not show the true condition. I do not think we can pay too much attention to any patient who has received a severe trauma, either directly or indirectly, as it is very frequently the case in which we suspect nothing more than a sprained back where we find a severe compression fracture.

I think the term "compensation neurosis," as just used by Dr. Fay, is a very fitting term. We have many of these cases in railroad surgery, and I often find that neurosis is very quickly cured by a settlement with the claim agent. In these cases I consider him a better surgeon than I am.

Dr. Fay, (closing): In reference to the remarks of Dr. Harris: I will say that I stated we allowed these patients to rest for a fortnight. We have been disappointed the same as Dr. Harris in the adhesive strap and in the use of plaster of Paris, and, while the bone may heal in a month, we keep the patient absolutely quiet for a fortnight and quiet afterward.

There is no doubt in my mind that the development of the *x*-ray has changed our idea of back injuries. The important thing is to find out whether or not the man is injured. If he is, give him the gold cure and be through with him. If he is not injured, do not do it.

RADICAL SURGERY AS AN AID TO EFFICIENT RADIOTHERAPY IN THE APPARENTLY HOPELESS CASES OF CARCINOMA

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After years of ceaseless search for a specific remedy, surgery still holds first place in the treatment of cancer and will probably retain that place until its cause has been discovered. Radium and other radioactive substances and the *x*-rays stand next in efficacy to-day. All other methods with but few exceptions have fallen into obscurity after they have lived the short life which the enthusiastic author in such case has been able to create for them. I can mention only a few of these, such as bacterial products, serums, arsenical preparations, atoxyl, salvarsan, kankroin, anti-tuman, quinine, resorcin, collargol, eosin, sclenosin, cholin, etc.

This does not mean that we shall cease in our efforts to find a specific. We may some day, when we have learned more of the etiology of cancer, be able to produce sera or chemical substances which will make the growth of cancer in the human body impossible. For the present, we shall take advantage in the fullest measure of the means we know to be efficacious, namely, *surgery* and *radiotherapy*, or the combination of both.

In this discourse I shall confine myself to the discussion of advanced cases in which surgical opera-

tion seemed inadvisable or in which one or more surgical operations had already been performed and recurrence had taken place. In choosing such material for our work, we must not get discouraged. We cannot expect the impossible. Neither must we enter upon this work in a half-hearted way. If we do we are apt to fail in doing our best. We enjoy other advantages in choosing this class of cases. We obtain greater coöperation with our patients. When we have failed we are not likely to be reproached, and, if we succeed in only a few, we shall have accomplished something.

It is regrettable that such deplorable cases should exist at all. With all of our efforts to educate the public and our attempts to drive out the quacks for robbing a credulous unfortunate individual of the one chance for his life; with all of our teachings and preaching to surgeons to operate on carcinoma early and radically—with all of these efforts we still meet with many hopeless cases. Is it not discouraging?

When confronted with a recurrent carcinoma of the breast or neck, for instance, the surgeon is apt to be too pessimistic. Usually the patient is referred to a röntgenologist for radium or *x*-ray treatment, partly to satisfy the hopes of the patient who in his despair is happy to believe that something more can be done for him, and partly because the surgeon does not yet know definitely the possibilities of radium and *x*-ray therapy. He hesitates to do anything more surgically because he feels that if he was not able to eradicate all of the cancerous growth at the first operation, a second operation is liable to be much more difficult, and not likely to be as radical as the first one. While recurrent cancer is not a promising field for the surgeon, still it seems to me that we have not yet exhausted all of our efforts in combating this dreadful disease. I have come to the conclusion that even in apparently hopeless cases something can be done, and I desire here to present a few suggestions.

Before recommending radium or *x*-ray, let us first investigate impartially their status in cancer therapy. What methods of investigation are available to arrive at the facts? Let us look up the credentials of those who advocate radium. The literature should be our main guide. The reports from clinics and individual observers of carefully recorded cases and our own experiences shall be our main witnesses. One who has followed the literature pertaining to this subject since 1910 cannot fail to be convinced that radium and *x*-ray when applied scientifically can produce beneficial results. The sceptic will ask, "If radium cures cancer, why do so many people die of cancer? If it can cure one case, why not all?" Our answer would be, "Why cannot all target shooters hit the mark every time?"

Many cases of cancer are treated with radium and *x*-ray by the most incompetent. Radium therapy is still in its experimental stage. The mortality from resections of cancer of the stomach was at one time 100 per cent. See what it is to-day. It took time to develop and perfect the technic.. The use of radium, like all other methods, should be employed by the competent. It is not sufficient, however, to leave the entire treatment to an expert physicist who knows all about the properties of radioactive substances and very little about pathology. It would be analogous to the idea of employing a chemist to treat heart diseases, because he had a knowledge of drugs. It requires an evenly balanced knowledge of pathology, surgery, and physics, in order to achieve the desired results.

We have all noted the beneficial effect of radium on superficial growths, such as epithelioma, which is essentially a malignant growth. The question naturally arises: If radium can destroy a superficial growth, why cannot it also destroy deep-seated carcinoma? Answer: Either the deep-seated carcinoma is made up of more resistant cellular life, or the rays are not able to reach the tumor on account of

the overlying structures. I am led to the conclusion that the latter is the factor, namely, that the deep-seated carcinoma when covered with skin, fat, and muscle cannot be treated quite as efficiently by radium, because these overlying tissues are barriers to

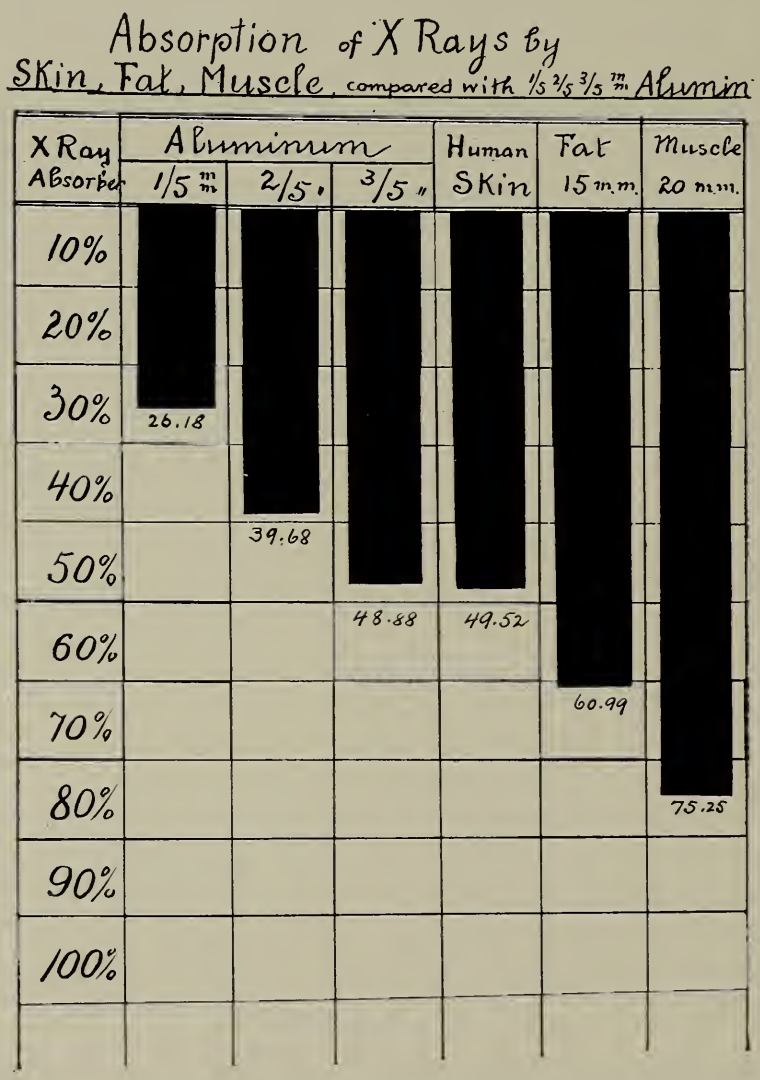


Fig. 1. Relative absorption of x-rays by skin, fat, and muscles compared with various thicknesses of aluminum.

the softer rays or the beta and some of the gamma rays of radium.

With the coöperation of Mr. W. G. Warner, the physicist of the Ryerson Laboratories, I published in *Surgery, Gynecology and Obstetrics* (October, 1919)

some experimental work which proved that human skin, fat, and muscles absorb large quantities of x-rays. The accompanying Fig. 1 illustrates graphically the absorption of x-ray by the skin, fat, and muscles compared with the absorption by different thicknesses of aluminum.

The skin, fat, and muscles which cover a deep-seated growth may be regarded as barriers to the penetration of the rays. They act as additional filters to the artificial filters of lead and aluminum which the operator usually employs to prevent burns of the skin. This is only one factor which diminishes the action of the radium. Another factor is this:

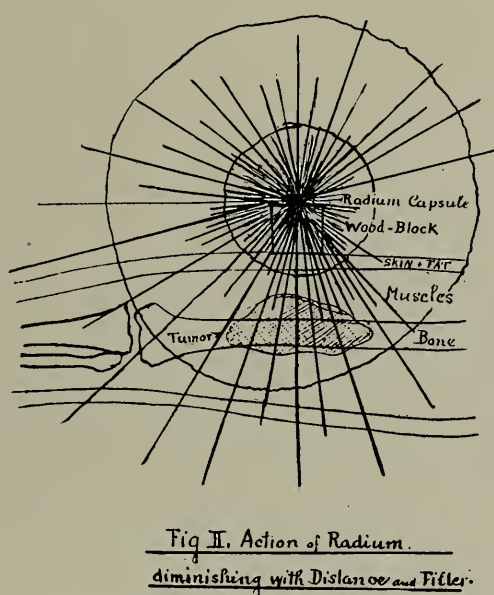


Fig. 2. Action of radium diminishing with distance and filter.

In order to prevent burns the radiologist interposes wooden blocks or similar substances to keep the radium a certain distance from the skin. In doing this he again minimizes the action of radium. By placing, for instance, 50 mgr. of radium upon a wooden block one inch square, we obtain only the rays which penetrate downward toward the block and lose all the rays which emanate upward and sideways. If the same capsule of 50 mgr. of radium

were inserted into the tumor itself, the radium rays would penetrate from all surfaces of the capsule and affect the growth in all directions (see Fig. 2).

The present methods of application of radium have, therefore, three shortcomings:

1. By placing the radium at a distance from the growth we diminish the activity.

2. By placing artificial screening of lead or leather over the skin we filter out the most effective rays.

3. A further reduction of activity of the rays is obtained by an additional absorption of rays by the skin and underlying tissues.

Thus we deliver into the tumor only a fraction of what might have been accomplished if the radium was placed within the growth itself.

I have come thus to the conviction that deep-seated cancer does not yield readily to the treatment with the radium because the skin, fat, and muscles are distinct barriers to the action of the most effective radium rays,—namely, some of the beta and a large portion of the gamma rays.

This fact suggested the idea that, *If the skin, muscle, and fat and as much cancer tissue as possible could be removed, so as to leave only remnants of the growth, the radium or x-ray could be applied directly into the cancer bed with no obstruction to the activity of the rays.* In other words, we could transform the deep-seated growth into a superficial one. To illustrate this principle, we shall make a schematic drawing which represents a cross section of the body, in the center of which is located a malignant tumor.

Let us suppose that the tumor in this case is about four inches from the surface of the skin. In order that the rays may reach the tumor, they must penetrate and pass throughout overlying tissues. These tissues will absorb all the beta and a portion of the

gamma rays. The gamma rays being very penetrating will reach the tumor; but that does not mean that all of them will be arrested in the tumor mass. A certain quantity will be arrested in the growth itself, and the balance will pass through the tissues beyond the tumor. When a ray is arrested in the cell, it will probably have a more deleterious effect upon the life of the cell. If it passes through the cell, it will no doubt injure it also, but not in the same degree as it would if it were actually arrested in it. We cannot ignore, therefore, the fact that the tissues above and beyond the tumor must suffer also. The burn of the skin proves this assertion.

When treating deep-seated carcinoma, having overlying tissues, we are obliged to use larger doses and more penetrating rays in order to deliver into the tumor the required dosage of rays for its destruction. If, for instance, three inches of fat and muscle intervene between the skin and the tumor, it will require much larger quantities of radium properly screened to obtain the required dosage than it would if the tumor were on the surface. By placing the radium directly into the cancer bed, smaller doses are sufficient. By reducing the dosage the action of the penetrating rays upon the structures beyond the tumor will be cut at least 50 per cent, thus sparing the normal tissues above and below the growth with consequent reduction of chances of producing a toxemia.

ACTION OF RADIUM ON CANCER CELLS AS COMPARED WITH NORMAL CELLS

Competent observers have stated that radium rays have a selective action on embryonic cells, and that it would require approximately five times the dosage of rays to destroy a normal tissue cell that it would require to destroy a cancer cell. This phenomenon requires an explanation. What physical law indicates

that a ray will select one type of cell in preference to another?

Would it not be more plausible to assume that the cancer cell has less resisting power against the injury of the ray than the normal cell? This assumption

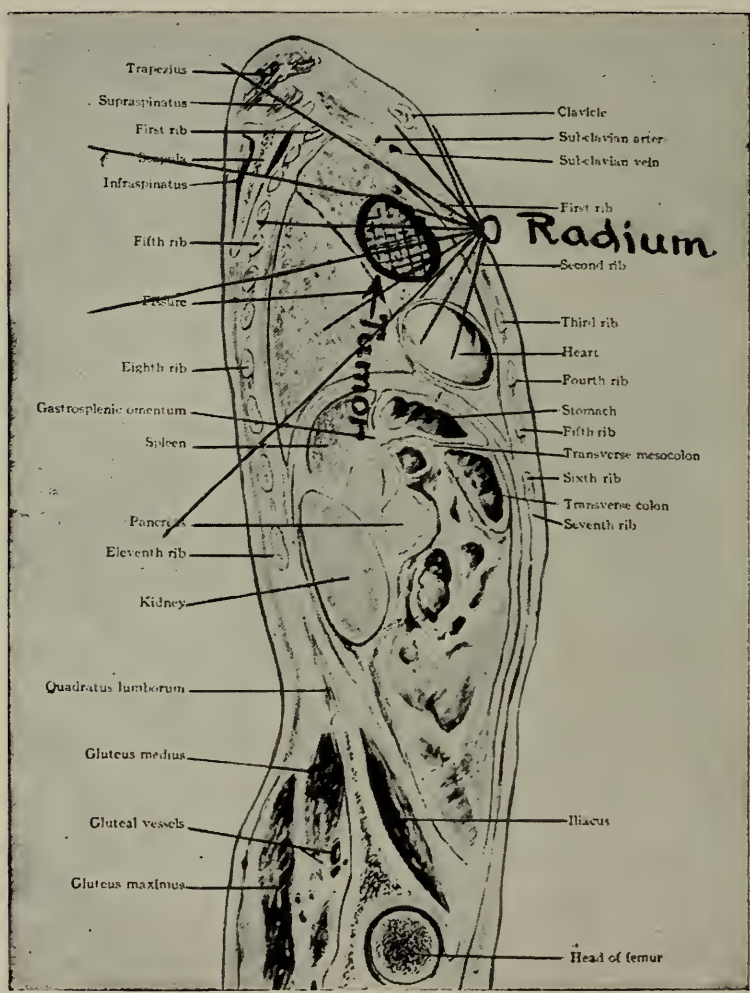


Fig. 3. Illustration of absorption of rays by tissue above and below the tumor when deep seated.

is further strengthened by the fact that the cancer cell is more easily injured by heat. Doctor Percy, of Galesburg, has demonstrated that heat will coagulate cancer cells at a temperature from 15 to 30 degrees lower than that required for the destruction of the normal tissues; thus in applying graduated heat in

carcinomatous regions the cancer cells will perish, while the normal cells will be spared within certain limitations of heat and distance.

To account for this lack of resistance in the cancer cell, or rather for the defence which a normal cell possesses, nothing definite is known. Many theories have been advanced, some of which seem reasonable, others less so. One of the most favored theories is the *embryonal.* It has been stated that the cancer cell is an embryonic cell and that all embryonic cells are less resistant, therefore liable to be destroyed by *x*-rays. This assertion brings up another question. How long does an embryonic cancer cell remain embryonic? Does it ever become mature? All cellular structures before they become mature must pass through the embryonal stage, just as human beings do. Whether the same law holds good in the case of cancer I do not know. Is it possible that the cancer keeps on increasing in size and still the cells remain embryonic?

Normal cells belonging to the body organization pass through the embryonal stage, become mature, fulfil their function, and when they are old they are broken down, eliminated, and replaced by new cells (metabolism). Does this also take place in the case of cancer, or does the cancer cell reproduction go on indefinitely without being broken down until exposed to external injuries, such as *x*-ray, heat, surgery, or accidents? If the rays are really more injurious to all embryonal cells, whether they be the embryonal of the normal tissues or the cancer cell, it would be a most dangerous procedure to expose the body to the ray because it would destroy the normal embryonal cell, which would mean practically gradual cell extinction. There must be some other factors in operation which give the normal cell protection against external injuries.

May I be pardoned in advancing another theory? This theory may serve by analogical reasoning to approach the truth of the matter. It is as follows:

A mass of cancer cells may be likened to an alienated detached and lawless community the members of which have no other function than reproduction and self-nutriment. They know how to appropriate for themselves plenty of nourishment at the expense of the whole body. These cells grow without any definite arrangement of structure or function, in a lawless manner, and *do not give any counter-service to the organism in return for the nutriment they receive.*

The growth is not under the control of the central nervous system. This community of cancer cells may be justly likened to some insurgent state or some groups of revolting men we often find in peaceful communities who do not wish to perform any labor and ask for everything that labor produces. They, too, appropriate plenty of nutriment for themselves in a lawless manner, a sort of anarchistic community.

Is it not likely that these recalcitrant cells (cancer cells), which render no service to the whole, are denied the same protection against all sorts of injuries which the normal working cell of the body receives? The normal cell belongs to the organism and is under the control and protection of the cell community. It may be that some enzyme or lack of some substance of the normal cell or some faulty arrangement of the chromozone weakens the resistance of the cancer cell.

Parallels have been drawn between the organization of human beings and cells to illustrate that our body is merely a composite of many individual little beings, each contributing to the welfare of the whole, just as each citizen contributes to the welfare of the human race. How far this coöperation in cell life carries its function and habits we do not know. Cells may be even better organized than the human family.

The present state of affairs among nations does not indicate a superiority of human organization over

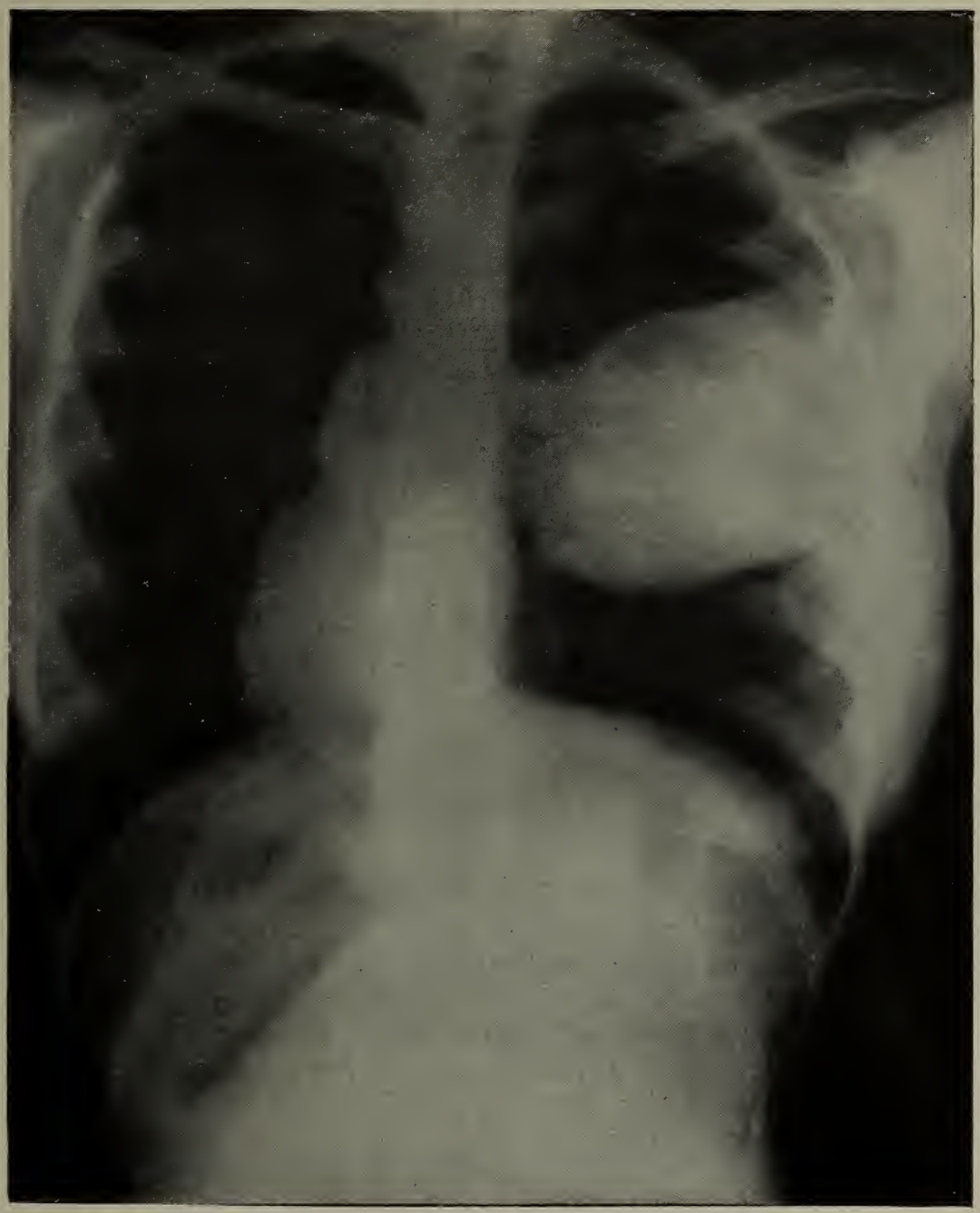


Fig. 4. Radiogram of sarcoma of the lung, illustrating size, July, 1920.

cell organization. There may be in the cell organization laws governing the nutrition and protection of the segregated clusters of recalcitrant cells. If there are cell workers, cell soldiers, cell judges, then why not cell thieves and cell prisoners? And so by analogy we may consistently reason that cancer cells do not share the same privileges that the normal working cells enjoy.

The central nervous system, which is the most important factor in the protection to cell life, is absent in the carcinoma growth. Pain which is associated with carcinoma is felt in the surrounding structures upon which the tumor impinges. This pain is a sign for help when the growth is trying to invade farther into the normal structures. The cancer itself has no sensitive nerve fibers and may be cauterized or cut into without the patient's discomfort, providing the surrounding structures are not touched.

This theory does not conflict in any way with the theory of irritation of epithelial surfaces. In fact, it would corroborate it. It may be easily explained that by some undue irritation the resting cells are called prematurely into activity, a process which may lead to lawless reproduction by their detachment from the central nervous system.

Having now outlined a mode of procedure by which we would obtain the maximum benefit from the combination of surgery and radiography, and having advanced a theory by which I attempt to explain why a cancer cell succumbs more quickly to radium than the normal cell, I will cite a few from a series of fifty cases to illustrate what may be gained by following my suggestion.

SARCOMA OF THE RIGHT LUNG—REMOVAL OF INTERIOR OF TUMOR AND SUBSEQUENT RADIUM THERAPY WITHIN THE CAVITY

Patient was referred to me on September 28, 1919, with the following history:

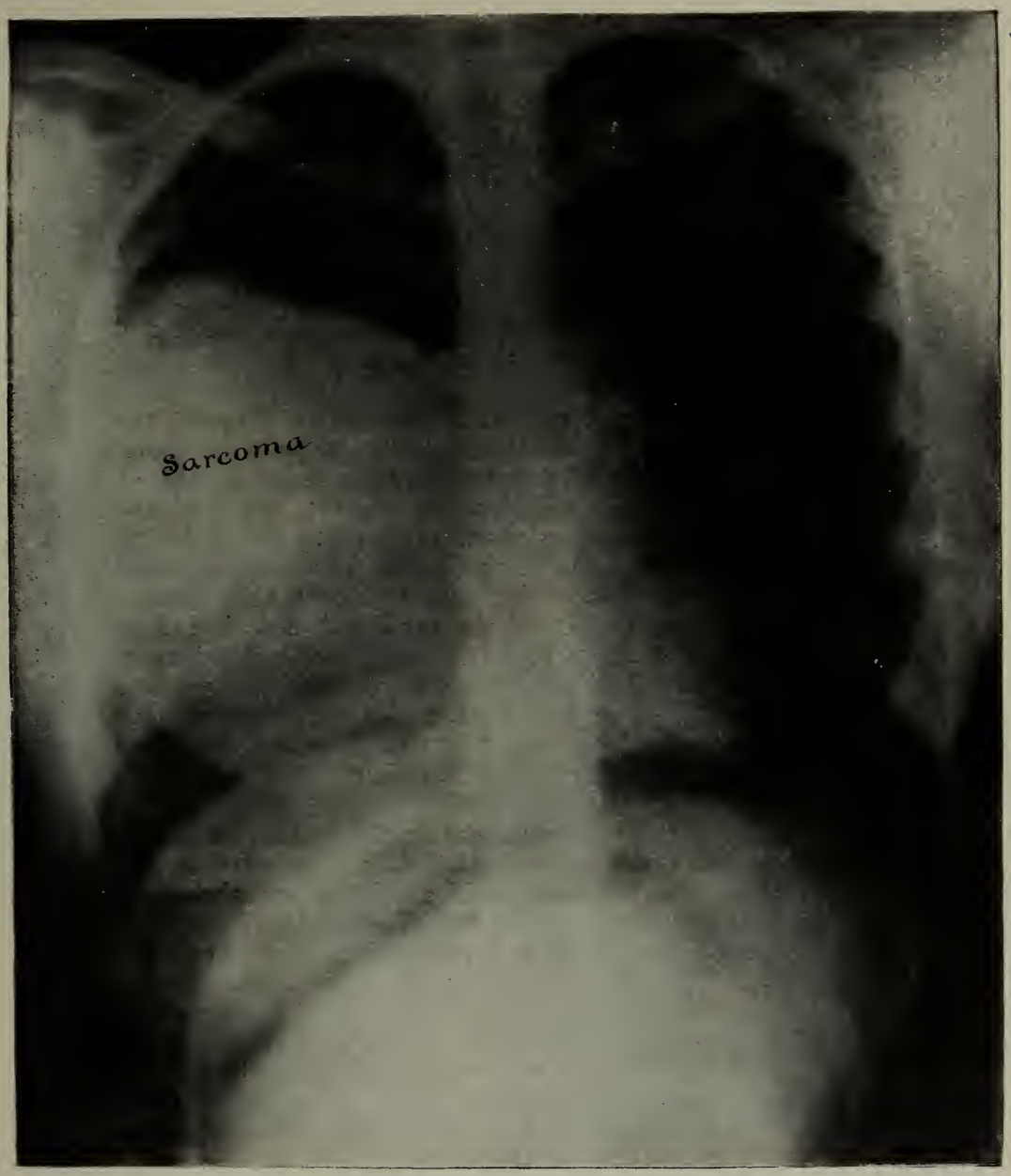


Fig. 5. Radiogram illustrating size of the same tumor Sept. 28, 1920.

She was then twenty-three years of age, unmarried, and her best weight was 126 pounds; present weight 124. Three examinations of sputum revealed no tubercle bacilli. Wassermann, negative; complement fixation for tuberculosis, negative. Afternoon temperature, 99.1°. Physical examination showed a few moist rales over the right hilus in front and back with no change in the percussion note. There was some slight enlargement of the thyroid. The x-ray stereos showed a well defined, clear-cut hilus shadow in the center of which was another round-shaped shadow about the size of a twenty-five cent piece. It was so round in shape and abrupt in its outer margin as to attract attention. It was not typical of tuberculosis or of anything which involved the lung tissue proper. In three weeks the fever and sputum had disappeared and the patient resumed her work as a nurse.

On April 7, 1920, the patient returned on account of the same symptoms of blood spitting followed by some clots, cough, and sputum. The cough had persisted for about three months prior to this, but the weight remained the same. Physical examination showed more decided dulness over the right hilus in the back. The x-ray showed that this original shadow was about three times as large. It was round and suggested the text-book description of hydatid cyst. Thinking that it might be a hydatid cyst, we made careful blood examination. No eosinophilia was ever found. Weinberg's antigen and a complement fixation with this antigen was negative. Wassermann and complement fixation for tuberculosis were negative.

In July, 1920, physical examination showed feeble breath sounds between the second and fifth ribs with a few crepitations. The tumescence in the lung was about the size of a navel orange, (Fig. 4). The sputum was negative for tubercle bacilli and for echinococcus hooklets. Neither could pus cells or elastic tissue be demonstrated.

On September 10, 1920, the patient had another attack, cough, and some hemoptysis, followed by bloody sputum for several days and an elevation in temperature. During this time the pupils were dilated. The physical signs were more definite over the right lung, and the x-ray showed that the tumescence had increased and was as big as a grapefruit. Present weight, 116.

September 21, 1920: Examination of the chest. Right lung: Dulness as low as the sixth rib. Fine rales in the first and second interspaces. The breath sounds, however, are not decidedly interfered with.

Fig. 6. First step in operation exposing pleura overlying the tumor.

Fig. 7. Removal of contents of tumor. (Note that the cavity is packed with gauze).

Left lung: normal.

When I saw her September 28, 1920, her condition was as follows:

She complained of shortness of breath; coughing mornings; expectorating small quantities of rusty sputum; losing slightly in weight; otherwise she was apparently normal.

Stereoröntgenograms revealed a tumor which occupied two-thirds of the right chest cavity; oval in shape and lying transversely within the diameter, reaching from the heart to the ribs (see Fig. 5).

A puncture was made with a long trocar, and about 10 c.c. of a fluid (almost normal blood) was withdrawn. This did not determine the diagnosis, and operation was decided upon and carried out in two stages, as follows:

October 15, 1920. Primary operation (under general anesthesia). A skinflap including muscles and fat seven inches in diameter was raised, (See Fig. 6.) Six inches of each of the fifth, sixth and seventh ribs were resected, exposing the pleura over the tumor mass. The skinflap was rolled up and fastened with sutures, thus leaving the entire square (about seven inches in diameter) exposed. The exposed pleura was then cauterized with silver nitrate stick, in order to produce adhesions between the tumor and the pleura. The open wound was dressed with vaseline gauze.

October 18, 1920. Second operation—three days later —under general anesthesia (gas and ether). The wound was exposed and a purse-string suture placed in the center of it to insure quick closure in case there should be uncontrollable hemorrhage. The tumor wall was then incised; the capsule was rather firm, but the interior of the tumor was composed of a semi-solid brain-like tissue, somewhat more solid, but not homogeneous. There were more solid portions than softer portions. It was possible to evacuate the contents in similar manner of delivering an adherent placenta. The mass was not entirely removed, although it would have been possible at the risk of more severe hemorrhage, as we could introduce the entire hand and wrist into the cavity and reach all portions, but we were satisfied to have opened the cavity and eliminated the greater part of the mass without breaking the capsule. The cavity was quickly packed with twelve face gauze sponges, (Fig. 7.) Patient left the operating room in good condition.

After-treatment—Forty-eight hours after, the twelve soft gauze sponges were removed under anesthesia. There

Fig. 8. Size of cavity two weeks after operation—ready for radium insertion.

Fig. 9. Size of wound reduction four weeks subsequent to operation.

was no hemorrhage. We removed another four or five ounces of the tumor mass from certain recesses of the enveloping capsule. The cavity was repacked. One week after the operation 50 milligrams of radium were introduced into the cavity in the center of a rubber ball, giving 600 mgr. hours, (Fig. 8.) The wound was dressed daily, and the following dosage of radium was introduced on the following dates:

October 28, 1920	600 mgr. hours
November 8, 1920	425 mgr. hours
November 18, 1920	450 mgr. hours
December 13, 1920	400 mgr. hours
December 22, 1920	300 mgr. hours
January 14, 1921	450 mgr. hours

The patient continues to improve and is gaining in weight on the average of two pounds weekly. The cavity has shrunken to one-twentieth its previous size. There are some small necrotic masses resembling degenerated sarcoma structure. The bronchial opening is still present, and when the patient is about to inhale or exhale there is a discharge of a serous mucoid substance, (Fig. 9.)

Stereoröntgenograms taken (Fig. 10) four weeks after operation show only a small remnant of the tumor mass, and the tumor wall very thin.

Pathological Report: The microscopic section of the tumor showed a spindle-cell sarcoma, (See Fig 11.)

The final report is reserved and will be made in about one year.

MALIGNANT OVARIAN CYST (CYST-ADENOMA) TREATED BY OPEN METHOD

Mrs. E. S. sixty-six years old, entered the hospital March 10, 1919. Since December, 1918, she noticed that her abdomen had grown to a very large size. She lost control of her bladder and lost considerably in weight. Her legs were swollen up to her knees. The diagnosis had already been made by her physician as a malignant ovarian cyst.

An exploration was made, the diagnosis was confirmed, and the case was considered inoperable. There was some fluid in the abdomen and intestines, and the enormous tumor was matted with intestines and studded with small growths resembling papillomata.

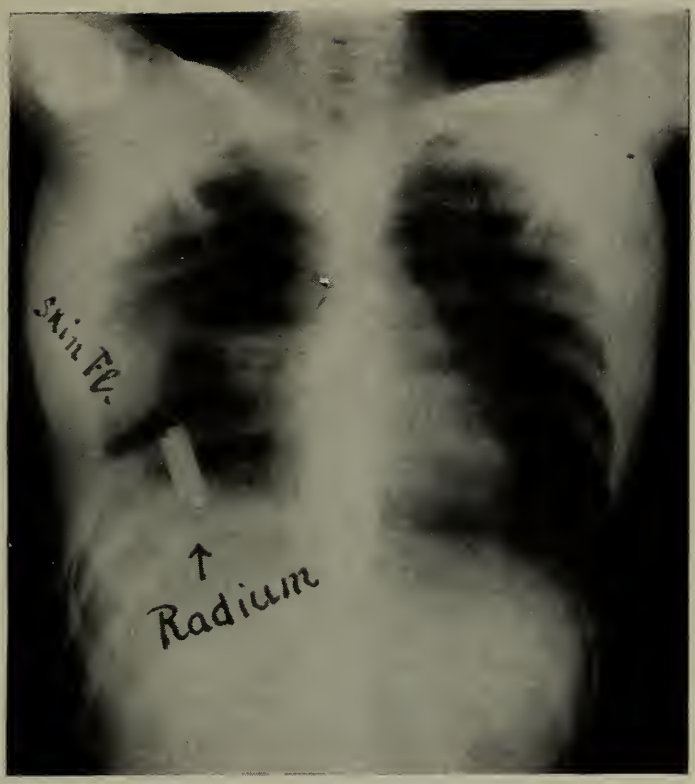


Fig. 10. Radiogram of chest taken four weeks after operation. Radium within the cavity.

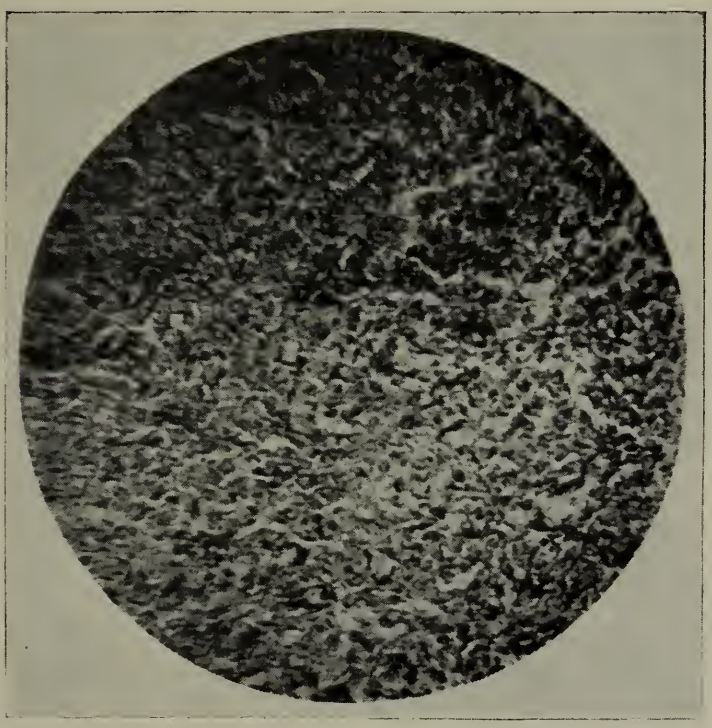


Fig. 11. Microscopic section of tumor showing spindle cell sarcoma.

The abdomen was closed. She received x-ray treatment for six months, which did not benefit her, for no effect was produced. The abdomen grew larger and larger until she could hardly breathe, (Fig. 12.)

In her desperation she insisted upon an operation, and the same was performed November 15, 1919 as follows:

Median incision from the ensiform cartilage to the pubes to deliver the tumor out of the abdomen. The loops of the intestines were firmly adherent to the base of the tumor. The tumor itself was firmly attached in the entire pelvis and thus was not removable in its entirety. The cyst was, therefore, opened and its contents, a gelatinous mass removed (about five quarts in quantity).

The upper two-thirds of the tumor was then amputated. The wall of the tumor being two to three inches thick in certain portions and again thinner in other parts. The edges of the skin were then sutured to the rim of the amputated cysts and the cavity packed with gauze so that there was a funnel-shaped cavity reaching the lowest part of the pelvis.

The interior of the cyst was then treated by direct application of radium at intervals of three weeks, 700 to 1000 mgr. hours being given each time. The radium treatments were supplemented with deep therapy, one erythem dose given every second day.

The cavity gradually diminished in size by contraction of its walls and absorption of the tumor, and the patient gained in general health and strength.

The abdominal opening into the cyst remained open for sixteen weeks in a suppurating condition, but finally closed, remaining so up to date, nearly a year and a half after operation. The patient is now attending to her daily housework, and has been able to take care of a very sick husband for nearly four months.

Fig. 13 shows introduction of radium into the cavity by curved applicator.

Comments.—(a) By eversion of the interior of a malignant cyst, we transformed an intra-abdominal into an external-abdominal tumor, and thus are able to apply x-ray and radium directly into the seat of malignancy. (b) It is safer to treat the tumor in this manner than to attempt complete enucleation. (c) It is preferable to treat with radium combined with x-ray to either alone.

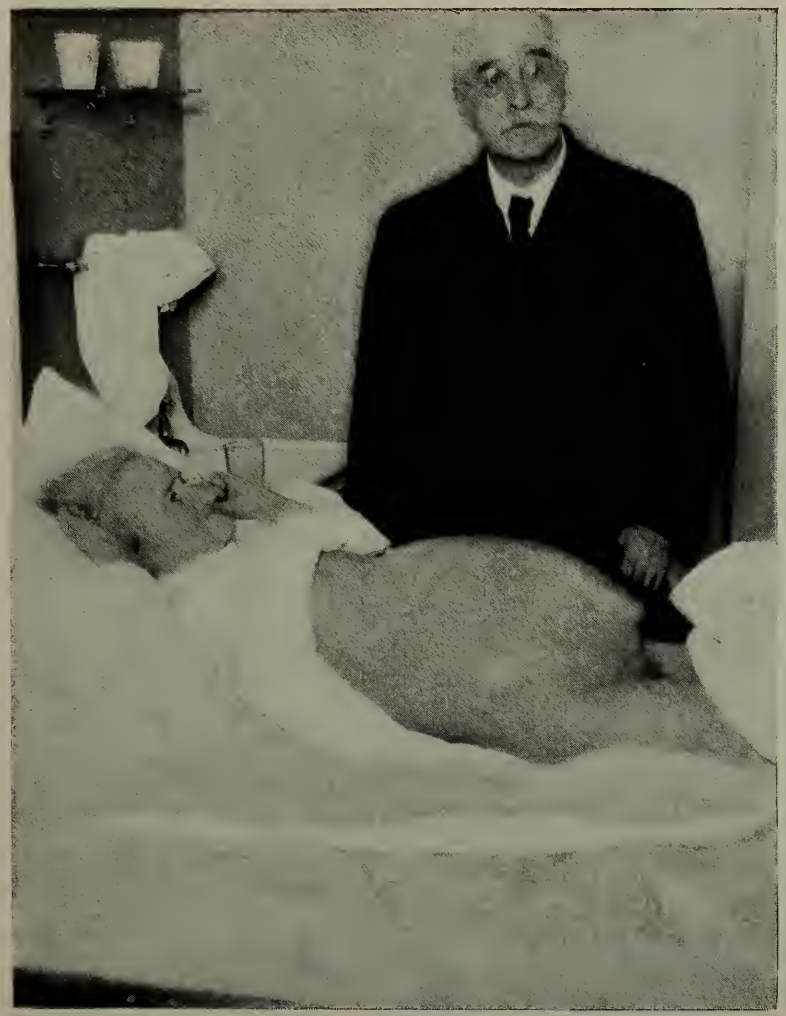


Fig. 12. Malignant ovarian cyst. Size of the abdomen before operation.

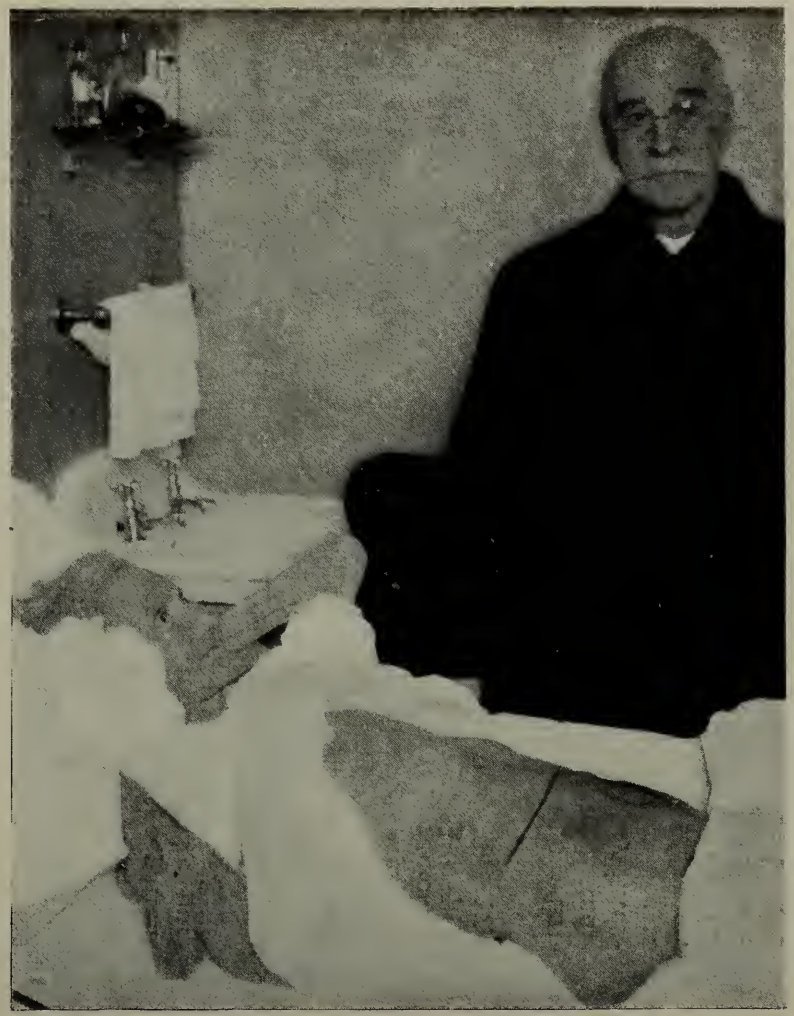


Fig. 13. Application of radium through funnel shaped crater into the interior of the cyst cavity.

For illustration of the attempt to treat sarcoma of the lung which involved also the neck and shoulder, I present the following:

PRIMARY SARCOMA OF THE LUNG AND SHOULDER

A. H., a boy fifteen years of age, was operated on April 28, 1920, for lymphosarcoma of the shoulder. Two months later a rapid recurrence was noted. The patient began to lose in weight, and the entire left side of the chest began to enlarge.

The patient presented himself December 3, 1920. He was anemic. He had a swelling on the left shoulder, extending from the middle line of the chest toward the shoulder, so that at present the anterior posterior diameter was several inches larger on the left than on the right, (See Fig. 14.) There is a hard mass involving the axilla, neck, and chest; the left pupil was smaller than the right. The pulse in the left wrist is hardly palpable, and his blood-pressure does not register at all, while on the right side it is 130—90.

The röntgenograms of the chest disclose a large tumor involving the upper part of the chest cavity and the region of the neck, shown in Fig. 15.

Amputation of the shoulder was refused by the patient and the open method exposing the tumor for the purpose of radium and x-ray was decided upon.

Operation, December 6, 1920.—The tumor was exposed by removing the skin, fat, and the pectoral muscles on the left side, leaving a circular area six inches in diameter, (Fig. 16.) A mass was protruding, having already entirely destroyed the overlying ribs by pressure. A portion of the tumor, about five ounces, was removed, but the largest part had to be left in as it was tightly adherent to the surrounding structures, (See Fig. 17.)

The wound was packed with gauze—no sutures whatever were used to reduce the size of the opening. Radium treatment was begun on December 9, 1920, by introducing a 50-milligram capsule within the deepest recess of the tumor mass, and three radium needles of 12.5 mgr. each were inserted directly into various parts of the tumor mass. The total dosage of the first treatment was 800 mgr. This was followed in quick succession by the following applications:

Fig. 14. Sarcoma of left lung and shoulder, with enlargement of the chest.

Fig. 15. Radiogram showing the size of the sarcoma within the chest and shoulder.

December 10	400 mgr. hours
December 13	600 mgr. hours
December 28	650 mgr. hours
January 3	600 mgr. hours
January 10	1050 mgr. hours
January 16	550 mgr. hours
Total	3,850

Total 3,850 milligram hours all inserted in the tumor mass.

The effect of the radium was mostly local. Only on January 12 we noticed a rather pronounced toxemia, which passed over in a few days, but the local effect was pronounced. The tumor was beginning to slough, assuming a grayish color and in places being almost black. The borders of the tumor became well defined in contrast to the normal structures surrounding the tumor.

This is illustrated in the frontispiece. The distinct sloughing character of the tumor in contrast with the normal and healthy appearance of the tissues around it proves the statement I previously made in this paper, that cancer cells succumb more quickly to the radium than the normal cells.

The illustration in this case is most convincing. The tissues belonging to the body proper have a healthy looking appearance and do not seem to have been affected by the radium, although it has been applied in considerable doses, while the tumor itself, which was as fleshy in appearance at the time of operation, is now a mass of grayish-green tissues, resembling an enormous core of a carbuncle.

Comment.—It is doubtful whether the tumor will ever entirely disappear; and the physical condition of the patient is not as good as it was before the operation. The toxemia and the frequent rise of temperature after the radium application are retarding the recuperation; but the case is here illustrated only as a guide to the direction in which we must work in order to finally succeed in similar cases.

The entire shoulder girdle should have been removed at the start so that the larger portion of the tumor might have been removed or at least so that the larger part might have been exposed to the radium treatment.

Final report of the case will be given in due time.

The microscopical section of the tumor shows a finding of roundcell sarcoma.

Fig. 16. Exposure of tumor by cutting away skin and pectoral muscle.

Fig. 17. Sloughing of tumor after first radium treatment.

SARCOMA OF FEMUR—BUTCHER'S AMPUTATION—RADIUM TREATMENT

On November 5, 1920, a boy ten years of age came into the North Chicago Hospital complaining of swelling on his right leg above the knee, which started only three or four weeks before. Until then he had always been perfectly healthy—no acute disease preceded this illness; syphilis was excluded.

Stereoröntgenogram showed a condition resembling osteomyelitis of the lower part of the femur. Sarcoma was not suspected.

An operation was performed November 10, 1920, exposing the femur; but instead of pus we found a granulomatous tissue surrounding the lower end of the femur and invading the bone. A large sequestrum about three inches long was present. The bone cavity was cleared of its granulomatous contents, the sequestrum removed, and two skinflaps inverted, which were prepared so as to leave the cavity open for later radium treatment, (See Fig. 18.) Stereoröntgenogram, Fig. 19, shows the amount of tissues removed and illustrates the condition of the bone after the operation.

The tumor began to grow rapidly after the operation so that within a week the granulomatous mass protruded out of the cavity, and hemorrhage occurred during each dressing. It was, therefore, decided to perform an amputation in the upper third of the femur.

Second operation (December 10, 1920).—Amputation was made without any preparation of skin-flaps to cover the stumps, but the bone was cut about three inches higher than the division of the muscles of the thigh. The edges of the muscles were drawn together over a rubber tube, which was inserted for the purpose of later insertion of the radium. The skin was temporarily fastened with four silkworm sutures, but these were not drawn tight; they were simply fastened to hold the skin from retracting too far from the stump. These were removed twenty-four hours after operation.

A day after the operation the patient developed a temperature of 104° and a deep scarlet rash. For a time it was suspected that scarlet fever had complicated the case, although the patient had been confined to the hospital for a month and, therefore, could not have been exposed to

Fig. 18 Removal of lower end of femur preparatory to radium treatment.

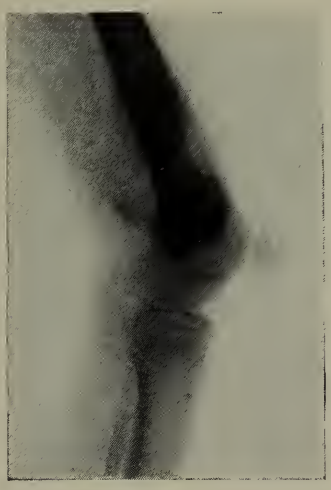


Fig. 19. Condition of bone before and after operation. (a) Note calcified areas surrounding the femur—condition resembling osteomyelitis. (b) Removal of two-thirds of thickness of femur including sequestrum.

any contagious case. In a few days the fever subsided and the rash disappeared.

Radium treatment.—December 19, 1920, a 50-mgr. capsule was inserted within the rubber tube underneath the muscles in the stump, (See Fig. 20.) At this time the wound was still widely gaping and no attempt was made to reduce its size. The following dosage has been applied thus far:

1920, December 19, 50 mgr. 7½ hrs. 375 mgr. hrs. applied in stump rubber tube.

1920, December 28, 50 mgr. 8 hrs. 400 mgr. hrs. applied in wound capsule in tube.

1921, January, 3, 50 mgr. 8 hrs. 400 mgr. hrs. applied in wound scr. L2 C2 R2.

1921, January 17, 50 mgr. 9 hrs. 450 mgr. hrs. applied in wound scr. L2 C2 R2.

The wound began to contract, and the patient's general condition improved, and at present there is a small area of still denuded skin, but perfectly healthy in appearance.

The surgical treatment in this case differs from the usual method of amputation of sarcoma in that we left the stump exposed, thus making it possible for the radium to come in direct contact with the raw surfaces and also within the tissues of the stump.

Microscopic examination of the specimen proves it to be a round-cell sarcoma—Very malignant in character. The sequestrum is illustrated in Fig. 21.

The specimen of the limb (Lumier B) shows the entire destruction of the lower end of the femur.

Stereoröntgenogram of the lungs showed a perfectly clear lung. No metastases.

A final report of this case will be given later.

It is useless at this time to draw conclusions from a small series of cases. At least three more years must elapse before we can make a report of a sufficiently large series, allowing ample time to know in how many recurrence had taken place.

Fig. 20. Butcher's amputation of limb ready for radium application.

Fig. 21. Illustrating size of sequestrum present within the femur resembling osteomyelitis.

At this time we can only state that we are not discouraged. In every case in which improvement occurred there was an actual gain, because, with the exception of only three cases, everyone submitted to this treatment was considered hopeless from the outset.

Our mortality was naturally very large on account of the extensive operations which had to be undertaken and also on account of mishaps, which might be avoided in the future. Four of our patients died of acute hemorrhage due to ulceration of the large blood-vessels, one from the femoral, one from the axillary, and two from the carotid. The hemorrhage was due to ulceration of the blood-vessels from placing the radium needle in too close proximity to the vessels. Four patients died as a result of Röntgen ray toxemia.

On the other hand, we have a number of cases which have stood a reasonable test of time. A case of carcinoma of the breast is still without recurrence two years after the last operation. One case of carcinoma of the submaxillary gland in which three radical operations preceded the last (which was the open method), has had no recurrence for two and a half years, and the patient is in perfect health.

There are a number of cases which have stood the one-year test. A number have been too recently operated on, are still alive, and we cannot yet make any comments on them. For the present then we can only say that we are encouraged, but not entirely satisfied. We have, however, gained the conviction that we have injured no one and have benefited a few.

I am sure that in the discussion the point will be brought up that in using radium emanations, instead of radium salts, the operative treatment may be omitted because the fine glass tubes introduced into the tumor itself will eliminate the objection set forth:

namely, the filtering of the rays by overlying tissues. Since emanations are not always available, and this is the case in probably 90 per cent of the cases treated with radium in the United States, the method here advocated will have its place in cancer therapy.

FOR DISCUSSION SEE PAGE 127

TOTAL REMOVAL OF THE SCAPULA FOR PRIMARY GIANT-CELL SARCOMA

Byron B. Davis, A. B., M. D., F. A. C. S.,

OMAHA, NEBRASKA

Complete excision of the scapula was first done in 1855, by Langenbeck. The chief indication for the operation is sarcoma, and, since this neoplasm rarely occurs primarily in the scapula, the number of excisions has been few. As regards the rare incidence of sarcoma of the scapula, the figures of Coley are illuminating. In 1910, he reported 251 cases of bone sarcoma that had come under his observation, distributed as follows:

Femur	117
Humerus	54
Tibia	40
Fibula	8
Radius	12
Ulna	7
Clavicle	11
Metacarpal	2

His list does not contain a single instance of sarcoma of the scapula. John B. Murphy, in 1915, showed a case in his clinic of sarcoma of the scapula, for which he did a total excision; and at the time he gave the distribution of 797 cases of bone sarcoma, as follows:

Head	23
Jaw	227
Thorax	20
Scapula	23

Clavicle	3
Humerus	90
Radius	90
Ulna	15
Hand	19
Ilium	17
Sacrum	6
Femur	160
Tibia	100
Fibula	25
Foot	29

This table gives only 23 cases of sarcoma of the scapula in 797 cases of bone sarcoma, making its incidence a little less than three-tenths of one per cent.

For his inaugural address as president of the American Surgical Society, in 1909, Nancrede chose for his subject, "End-Results after Total Excision of the Scapula for Sarcoma." All the cases he could find records of at this time in the world's literature were 65, and of the whole number, only 1 was nearly certainly cured. In the face of this appalling mortality, Nancrede concluded that, in the future, he would recommend intercostohumeral amputation in preference to total removal of the scapula.

Fowler, in his "Treatise on Surgery," says that in a fortunately early case of sarcoma of the scapula, there is a possibility of a successful excision "but the instances must be few and far between in which such a course would not be followed by recurrence."

September 5, 1921, Mrs. F. C., age 27, consulted me for an enlargement of the left shoulder blade. She gave the following history:

She has had measles, smallpox, and whooping cough. Otherwise she has always been well except for her present trouble. September 9, 1919, while trying to raise herself upon a log, her left hand slipped, and she felt a sharp pain in the left shoulder. She is certain that she did not strike her shoulder against any object. For about a month after this occurrence, when exercising her arm she

experienced pain over the left scapula. At the end of a month this pain disappeared and she noticed nothing more until August, 1920, when, after swimming for a long time, she felt some aching in the region of the left scapula. She was married in October, 1920, and, after this, when doing housework, she noticed, at times, pain over the scapula.

While going down the cellar stairs, December 22, 1920, she tripped and threw out the left arm to catch herself, and there was a sudden sharp pain in her left shoulder blade. The pain lasted about 5 minutes. The pain immediately subsided, and she forgot all about it until 6 days later, while visiting in Creston, Iowa, she noticed in the mirror, while raising her left arm, an oval swelling about the position of the body of the scapula. This swelling she described as about 2 inches long and 1½ inches wide. She consulted a doctor, who told her she had a fracture of the left scapula, but gave her no treatment During the next few weeks, the swelling extended more posteriorly. From this time on she had occasional pain when she moved her arm vigorously.

At Easter, in 1921, she burned her finger and jerked her arm away, and there was severe pain over the scapula for a few minutes and soon it became more swollen. She consulted a physician in Lincoln, Nebraska, who told her to paint iodine over the swelling. Under this treatment she says the mass diminished in size considerably, but in about a month she found it was growing again.

In June, 1921, a roentgenogram was taken and she was again told she had a fracture of the scapula. Since Easter there has been pain over the scapula whenever she uses her arm.

In August, 1921 she consulted a surgeon, another x-ray was taken, and the diagnosis of sarcoma of the scapula was made for the first time.

My physical findings at this time were as follows: The body of the scapula is very much enlarged and rounded, making it very prominent, the mass being at least 3 inches, possibly 4, in thickness. The skin is movable over the mass, and the scapula is freely movable over the chest wall. The mass is only fairly firm in consistency and crackles slightly when pressed. The range of motion of the arm is only slightly

limited. There are a few superficial dilated veins, coursing over the tumor. The x-ray indicated a sarcoma of the body extending up along the anterior border to, but apparently not including, the glenoid cavity. Clinical diagnosis: sarcoma of the body of the left scapula. Removal of the scapula was advised and she entered Immanuel Hospital, September 9, 1921.

Fig. 1. Röntgenogram showing tumor of the scapula.

Operation, September 12, 1921.—Drs. Herbert Davis, O. E. Olson, and E. K. Eskildsen assisted, and Dr. J. S. McAvin gave gas and ether. An incision was made from the inner border of the axilla outward along the course

of the coracobrachialis muscle. The axilla was opened, its anterior fold retracted forward, and the tip of the coracoid process reached with the finger. The pectoralis minor muscle was hooked up and cut with scissors. Next the coracobrachialis was pulled up with the retractor and cut, after which the short head of the biceps was raised on the retractor and cut, all of them at a considerable distance from their attachment to the coracoid process.

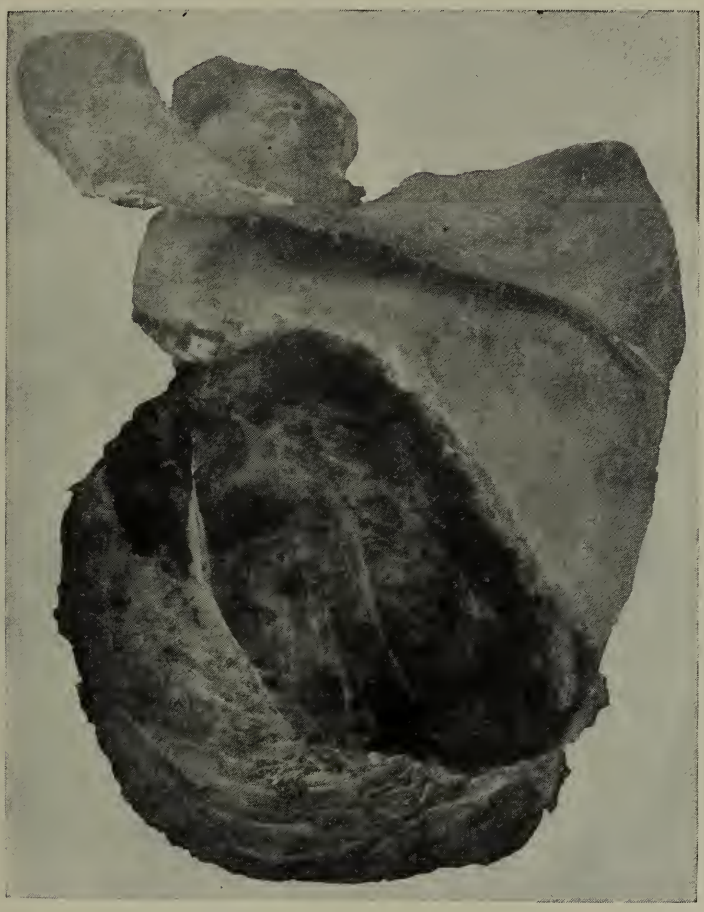


Fig. 2. Gross specimen of tumor of the scapula.

The subscapular artery and vein were made easily accessible and were ligated doubly and cut between, and the axillary wound packed with gauze.

To make the field of operation accessible for the next step the patient was turned on her right side. An incision was made from the superior angle of the scapula, along the vertebral, border to the lower angle. Another incision was carried from the tip of the acromion process along the spine of the scapula until it met the first in-

cision The skin flaps thus formed were dissected up sufficiently to uncover an area corresponding to the scapula. The trapezius muscle was now cut away from its attachment to the scapula at a short distance from the bone. Next, the minor and major rhomboids were severed, also at a little distance from the vertebral border of the bone. The latissimus dorsi was found to be attached to the lower angle by a few fibers, which were divided, and following up the anterior border, the teres major and minor muscles were both cut. The finger was next inserted underneath the flat serratus magnus and the entire muscle was cut just before it passed behind the external border of the subscapular muscle.

The lower angle of the scapula was then raised from the thoracic wall and everything loosened from behind;

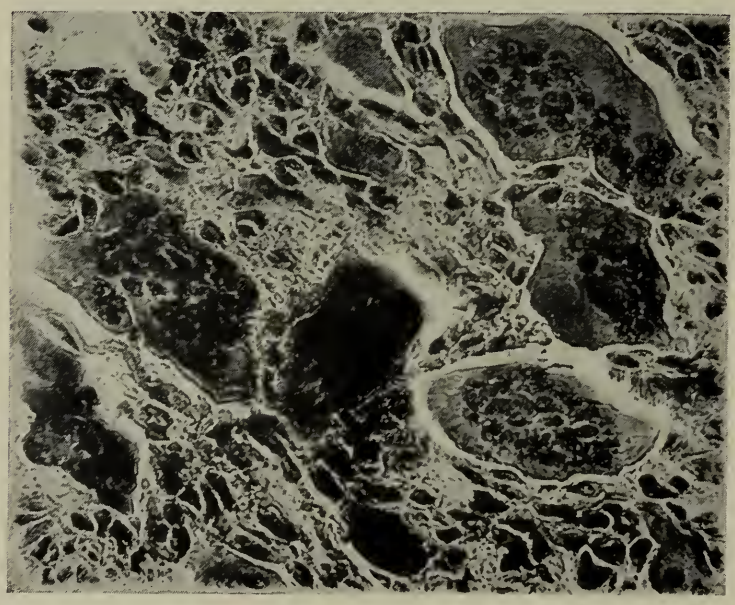


Fig. 3. Photomicrograph of section of tumor removed.

then, passing upward, the levator anguli scapulæ and the omohyoid muscles were cut. At this point both the descending branch of the transverse colli and the transverse scapular arteries were cut and tied. The deltoid was now separated from all its scapular attachments and the acromion process was disarticulated from the clavicle. The humeroscapular joint was then opened, and the humerus separated from the glenoid cavity. The long head of the biceps and the long head of the triceps were divided, after which the coracoid process was freed from what attachments remained.

After tying all the bleeding points a running suture of catgut was used to gather a mass of muscles about the head of the humerus in such a way as to form a muscular pocket. The skin wounds were closed with dermal stitch and a small rubber drainage tube was inserted at the meeting point of the two skin incisions.

The patient was turned on her back and the axillary wound closed, leaving a small rubber drainage tube. The wound was dressed, the elbow being kept abducted somewhat away from the chest wall.

There was some shock, from which patient had fully rallied within 6 hours. The muscles were all divided almost an inch away from their attachments to the scapula. As the operation proceeded, it was remarked how little trouble was experienced from hemorrhage. Sir W. Watson Cheyne was the first to recommend preliminary ligation of the subscapular artery, and it seems an excellent procedure. The most difficult part of the operation as usually done is separation of the coracoid process; by dividing the three muscles attached to this process through the axillary wound the operation is much simplified.

September 18, the patient was able to brush her teeth, using the left hand to hold the tooth brush, and she sat up for the first time.

September 19. Sat up 2 hours during the forenoon and is feeling fine.

September 20. Combed and arranged her hair. She was encouraged to use the hand in every way possible, several times daily.

Discharged from hospital and recommended to exercise the arm as much as possible without discomfort.

The following statement was made by her in a letter written me November 30, 1921: "In regard to my arm I find it is still gaining in strength. I can take care of general housework, such as making beds, sweeping, dusting, ironing, sewing, dishwashing, etc. I find my hair-dressing is improving too. It is not such an effort to comb my hair now and the result is also much better.

Fig. 4. Photograph of the patient after operation, showing the scar and her ability to raise her hand above her head.

The grip of the left hand is as good as the right. People have told me here they had not noticed by appearance, or action that I did not have full use of my arm."

Pathological examination by J. Jay Keegan, M. D., from the pathological department of the University of Nebraska Medical College:

"Pathological examination of the tumor of the scapula of Mrs. C. showed a rounded tumor mass involving almost all of the axillary border below the glenoid fossa, the inferior angle, and extending along the vertebral border a distance of 1½ inches. The weight of the entire specimen including muscles was 805 grams, with muscles removed 425 grams. The tumor mass measured 4 inches in length, 3½ inches in width and 3 inches in depth, being flattened against the chest wall. Its consistency was soft, almost fluctuant in the center, with a few spicules of bone palpable. It was enclosed in a definite capsule except at the inferior angle and below the glenoid fossa, where reddish granular tumor tissues appeared.

"Microscopic examination of one of these granular areas showed a very characteristic giant cell sarcoma. Three types of cells were present: a stroma of elongated spindle cells resembling fibrous tissue, this enclosing areas of larger fusiform cells and multinuclear giant cells. The operative removal was sufficiently wide so that no tumor tissue was incised. This type of tumor is considered relatively non-malignant as it rarely metastasizes and complete removal usually results in a cure.

The only questionable areas were two places where the tumor appeared to have broken through the capsule."

As far as it has been possible to ascertain in a rather extensive search of the literature, this is the first case of unquestioned giant-cell sarcoma of the scapula yet reported. I am free to admit that before the case was operated upon, it was not certain what type of sarcoma we had to deal with, though, from the history and the rather slow development, it was felt there was good ground for considering it a mildly malignant growth and entertaining a lively hope that it was a giant-cell tumor.

It is, I believe, to Nélaton, that we are indebted for first fully establishing the benign course of giant-cell sarcoma, and the good results of conservative treatment. But the careful observations of Bloodgood and the fearlessness with which he has put the conservative treatment of this class of cases on a workable basis have done much to standardize our knowledge. The last report of his I have been able to obtain gives 47 cases of benign giant-cell tumors in which the ordinary features of malignancy were absent.

Coley has been working on the same line, but in his 40 cases of giant-cell sarcoma, the diagnosis being confirmed by leading pathologists, 8 have died of metastases.

The gross appearance of these tumors is variously described as "reddish jelly-like tumor masses resembling granulation tissue," "rather soft and, on section, resembles splenic tissue, or even currant jelly." They pulsate and even after they have absorbed the bone and broken through in places, the true giant-cell tumor shows no disposition to infiltrate the soft tissues.

Histologically this species of sarcoma consists of giant-cells so numerous and so uniformly distributed as to give a characteristic appearance under the microscope. These giant multinuclear cells are not the sole cellular elements of which the tumor consists. There are also round or spindle cells grouped around the giant cells, which vary in size and shape. They are usually round or oval, sometimes having a uniform margin and sometimes being very much broken in outline, with protoplasmic masses extending out from the main body of the cell.

Several surgeons and pathologists, notably Bloodgood, Coley, and Platou take the position that these giant-cell tumors are always permanently benign and that it is entirely justifiable to treat them conservatively by curetting out the soft tumor tissue mass,

or doing a conservative resection of the bone, or, if very extensive, an amputation may rarely be required. Others are not so certain. Ashhurst seems to take the ground that, although the real giant-cell sarcoma does not metastasize, it may occasionally undergo sarcomatous change, when it begins to grow rapidly and recurrence is usual. Even Ewing, who holds to the benign character of giant-cell sarcoma, admits that as the spindle cells of the stroma become more active and abundant, the giant cells diminish, the resemblance to granulation tissue is less in evidence, and the tumor comes more and more to resemble a spindle-cell sarcoma. When this point is reached, local recurrence, destruction of bone, and infiltration of soft tissue occur, but Ewing has never known such growths to metastasize.

The exact line of separation between the entirely benign giant-cell tumor and the sarcoma with a superabundance of giant cells, which does infiltrate, which does form metastases, seems yet somewhat imaginary, and there seems to be some danger of ultraconservative treatment being carried too far.

DISCUSSION OF THE TWO PRECEDING PAPERS

Dr. James F. Percy, (San Diego, Calif): I am glad to welcome Dr. Beck as an ally in the treatment of inoperable cancer. The great merit of Dr. Beck's work is that he has attacked a type of cases that heretofore were considered absolutely hopeless from the standpoint of operative treatment, mainly because they were inaccessible. I refer especially to this technic in the treatment of malignancy in the lung. I was glad to hear him emphasize a fact to which I have tried to call the attention of the profession for many years, namely, that you cannot tell by the looks of a malignant growth just how actively malignant it is. It is from the gross appearance of the growth, unfortunately, that we have heretofore based our decision as to what we should attempt in the way of treatment: if it looked bad to us we let it alone. The practical fact is that in many instances the case that seems the most inoperable may have reached the stage where its malignancy had already exhausted itself, but if untreated the patient will die, not from the malignancy,

but from the secondary infective changes that have been set up and that are slowly devitalizing the patient.

I think Dr. Beck would do better if he did not use the knife at all because you cannot convince me from any data that have so far been presented that when you open up blood vessels and lymphatics through, or even near, these inoperable masses you do not greatly increase your percentage of chance to disseminate carcinoma. This was impressed upon me in 1897 when I was a student in Ziegler's laboratory in Freiberg. In making sections from a carcinoma of the breast I fortunately ran across a series where the carcinomatous process had gone through a blood-vessel wall, which you know is rare, and the fixing material had caught the cancer cells as they had poured from the mass through the hole into the blood-stream. The same thing happens when we use the knife. We open up new channels for the dissemination of the disease. If it does not happen, you know and I know, it was luck and not design that saved the patient from recurrence in the operative field. With the hot knife this danger is practically done away with.

Dr. Beck is following up his use of the knife in these patients by x-ray and radium. There is no question about the value of these agents in superficial growths, but from my experience with them, especially the x-ray, I seriously doubt their value in the deep growths. It is true that Dr. Beck has removed the greatest obstacle to their use by removing the skin; and from the results he has reported in these otherwise inaccessible growths he has developed a most promising technic because he has made the deep growths, wherever possible, more or less superficial. The most important part of Dr. Beck's technic is the one that it of necessity provides for drainage after the use of the x-ray or radium. Without this his method would fail because, if you do not drain, absorption from the broken-down mass kills the patient in a seriously large percentage of cases.

Dr. Miles F. Porter, (Fort Wayne, Ind.): I would suggest one thing. It seems to me that there can be no possible objection in a case like the one Dr. Davis related to finding out exactly what the tumor is before he operates. If it is a giant-cell tumor, all it needs is local removal. There is no objection to taking a specimen of the tumor, having a section made, and making a comparatively trivial operation and curing the patient. I cannot see the logic of leaving two or three inches or millimeters of good bone tissue in tumors of this type. We have reached a point where we are at liberty to explore suspicious tumors of

this sort, and let our further operative procedures depend on the result of the examination of the frozen section.

Dr. Arthur E. Hertzler, (Kansas City, Mo.): I would suggest that the essayist keep in mind the difference between periosteal and endosteal giant-celled sarcomas. The periosteal type is prone to recur, no matter how radical the treatment.

Dr. Charles D. Lockwood, (Pasadena, Calif): I think we ought to call attention to the number of cases of sarcoma of bone collected by Bloodgood and Codman. They have collected 200 cases and have compiled a lot of information regarding the treatment and prognosis of these tumors that will be of value in the future; and I simply call attention to that registry which is being kept by Bloodgood and Codman of all sarcomas of bone.

Dr. Beck, (closing on his part): I would like to ask Dr. Davis whether any postoperative radiation was given in this case, and whether the lung has been radiated or röntgenogram taken for possible metastasis in either lung. I personally think they ought to be radiated.

In regard to the objection to the knife in preference to heat: both have their uses. Since we are leaving the wound open and are applying radium or x-ray subsequently, if anything is true, they destroy cells, it will make no difference whether we apply heat or the knife. If any cancer cells are thrown on the open surface they will be eliminated very soon with the radiation. The statistics or end-results bear out the usefulness of either method, but I think the heat has this advantage in itself: Heat to a certain distance will destroy cancer cells, as cancer cells are less resistant than normal cells,—at least 80 per cent less. It takes five times the amount of radiation to destroy a normal cell or cells after operations, depending on whether it is a brain cell or a lymphocyte, the lymphocyte being more radioreceptive. But it requires five times less heat to destroy cancer cells than it does normal cells. Therefore, heat has its place. I am satisfied with the knife, therefore I have no reason to change. However, I have seen very good work done with the cautery, both by Dr. Percy and others, and I do not speak against it, but I think the knife will be employed in surgery every time when you have to dissect around the blood vessels and nerves. They will be injured by the heat, although they may not according to Dr. Percy. However, I would like to have a knife in order to dissect the tumor from important struc-

tures. They might undergo ulceration as long as there is a damage to the vessel and might rupture. That has happened in four cases in the use of radium, so that the blood-vessel walls are no guarantee against such injury.

Dr. Davis, (closing): In reply to Dr. Beck: I have for a good while made it a practice when dealing with carcinoma or sarcoma to get a skiagram of the lung, and, if the trouble has been in existence very long, skiagrams embracing the entire skeleton. This case showed nothing in the lung.

In reference to using the x-ray in this case: I am not using it for the reason the case turned out to be one of the giant-cell type; and we are taught that in the giant-cell type of sarcoma, there is no necessity for using the x-ray. We simply save the patient additional expense and needless distress.

Coley reports 40 cases, having had the best pathologists of New York City examine them, and they were pronounced pure giant-cell sarcomas. A thing that throws doubt on a conservative attitude in these cases is that a patient with a giant-cell sarcoma dies sooner or later of metastasis. So I think we are not yet on certain ground.

COMMON DUCT REPAIR

Lewis L. McArthur, M. D., F. A. C. S.

CHICAGO, ILLINOIS

Confronted, during an operation, with my first occasion to make a repair of a strictured common duct, it became necessary to improvise a method for the following case:

Geo. L., of Potosi, Wis., was referred to me through the courtesy of Dr. Lewis, of Dubuque, Iowa, an epitome of whose history is appended.

Case 1. A man of middle age (48?,) who, while seeking operation for a simple right inguinal hernia at a neighboring clinic awoke to find that an appendectomy and the removal of a stone from the gall-bladder added to his herniotomy, had been done. With a biliary fistula persisting for a year, he returned to the Clinic, when a cholecystectomy was done, with prompt recurrence of the biliary fistula. After another year's interval of alternate opening and closure, followed by jaundice and fever, he returned for the third time to the Clinic for search for the source of common duct obstruction. During this fourth interference, so severe a hemorrhage occurred as to make it necessary to desist, leaving the hemostatic forceps in situ and packing the wound, returning the patient to bed to recover from loss of blood, shock, and so forth. The patient recovered and the wound healed (with the fistula persisting), he returned home. While the fistula was draining the patient was comfortable; when closed for three or four days there was recurrence of jaundice, chills, fever, and common duct symptoms. After a lapse of several months the patient was brought to the writer.

October 1, 1907: On this date and with the above history, an exploratory operation was made, following with great difficulty the course of the fistulous tract through a mass of adhesions of the stomach, liver, colon, and duodenum, to its source in a small remnant of the cystic duct big enough to admit the index-finger tip, and containing mucopurulent bile with black biliary grit. Splitting open this

pouch and its communication with the common duct, the latter was found dilated above this point sufficiently to permit palpation of right and left hepatic branches; below this point, an average sized probe could be passed down into the duodenum. Two stones could be felt and they were removed from the dilated common duct, mixed

First tube too short. In place 9 weeks. Second operation; full-length catheter inserted, and passed by bowel on the 27th day.

with mucopus and grit. With the probe down the common duct, palpation revealed the duct, surrounded by much indurated cicatricial tissue, but, as the duct was patulous to probe and fluids, no effort was made to remove the narrowed portion or to divide the same. A No. 6 soft rubber catheter was passed down into the duodenum,

and the wound was closed after excision of the remnants of the cystic duct.

Recovery was uneventful. The catheter was utilized while in situ to flush out the circulatory system and kidneys by introduction of two to three litres of sterile water daily into the duodenum, this clearing up the jaundice rapidly. ,

The patient returned home in seven weeks with the wound closed. On March 19 he writes as follows: "December, 1907, first week, wound reopened for several days. December 21 chills, fever, general aching, wound reopened. December 23, wound closed and has not reopened to March 19, 1908. No soreness or tenderness at site of incision; stools of good color up to time of attacks, then still yellow, but lighter; no colic at any time; no pains in shoulder or side; there is some jaundice and itching."

Between April and August, 1908, occasional repetitions of these obstructive symptoms, with septic reactions, led to the reopening of the wound on August 29, 1908, and the finding of a stricture below the formerly opened area, the common duct being this time opened nearer the duodenal junction. The probe passes easily into the duodeunm. When trying to probe upwards, stricture found that admits only the smallest size probe. Divulsion of stricture and excision of scar tissue sufficient to admit No. 16 English sound. On splitting open the stricture, several small black biliary calculi are discharged with free flow of bile. Insertion upward into dilated duct of rubber tube with double revers cuff; fastening same there with chromic gut, then passage of other end well down the duct into the duodenum so that six to seven inches are free in duodenal lumen. Wound closed with cigarette drain down to junction of duct ends.

Healing uneventful; no bile escapes through wound; patient returns home in five weeks; all symptoms disappear.

November 1, 1908: Patient writes: "Tube passed this morning; 63 days since its insertion. Am better than I have been for three years".

November 21, 1909: Reports self better than for four years, after extended trip through West. Has none of the old symptoms.

The patient died some years later from a stomach carcinoma.

Disregarding the free fascial transplants as having proven but temporary successes, and avoiding the much more serious surgical procedures of Walton and Mayo there remains the utilization of some form of tubular reconstruction.

Search through the literature fails to reveal earlier application of this method of correction of common-

Right side of patient

Full-length catheter in duodenum and duct. Anchored by silk thread to adhesive plaster on surface. In situ 4 and one-half months. Anchor suture cut Sept. 14; tube passed by rectum Nov. 7.

duct defects, and not until 1909 did Sullivan report the results of his laboratory experimental work along these lines. In an analogous manner, in November 1905, Jenckel, of Germany, endeavored to establish a new canal by using a tube, one end of which was sutured in the proximal duct, the other inserted

through an opening into the duodenum, made after the Witzel method for temporary gastric or intestinal fistula—that is, by burying the tube by suture in a fold of the duodenal wall for one or two inches before perforating the same. The sole value of Witzel's suggestion is quick obliteration of the temporary tract and closure of the fistula on removal of the tube. The very thing to be avoided, then, in establishing a new channel of this nature! In point of fact, in the case mentioned, Jenckel after three weeks inserted his finger into the fistulous tracts to remove the tube, and by traction on it tore open the duodenum along the Witzel suture, with a resulting desperate duodenal fistula and extremely tedious convalescence. Strangely enough, after months the wound epithelialized internally sufficiently before it healed externally to establish a nexus between the proximal stump and duodenum! so that after more than a year's time, the patient was discharged, cured.

Following Sullivan's early recommendations there came many applications of the same in practice, usually with some means for the removal of the tube, like the well-known T tube, now largely abandoned because many times the short arm of the T tube has broken off in the duct during the effort to extract it, thus necessitating another surgical interference. If a T tube be used, a caution should be voiced as to the danger of rotting very quickly the rubber by the injection of vaseline or oils after Bevan's suggestion, as tubing is very speedily rendered friable thereby. The tying of a strong ligature to the tube in situ, so that it may be pulled out after some months, has the disadvantage of tearing open the newly formed duct, with a potential recurrence of stricture. The recommendation to leave the tube permanently in place is to be condemned, because of the ultimate deposit of bile, with recurrence of symptoms as in Case 2. (Mrs. B.).

As yet I have found no reference to the dependence on an enlargement of the proximal end of the tube

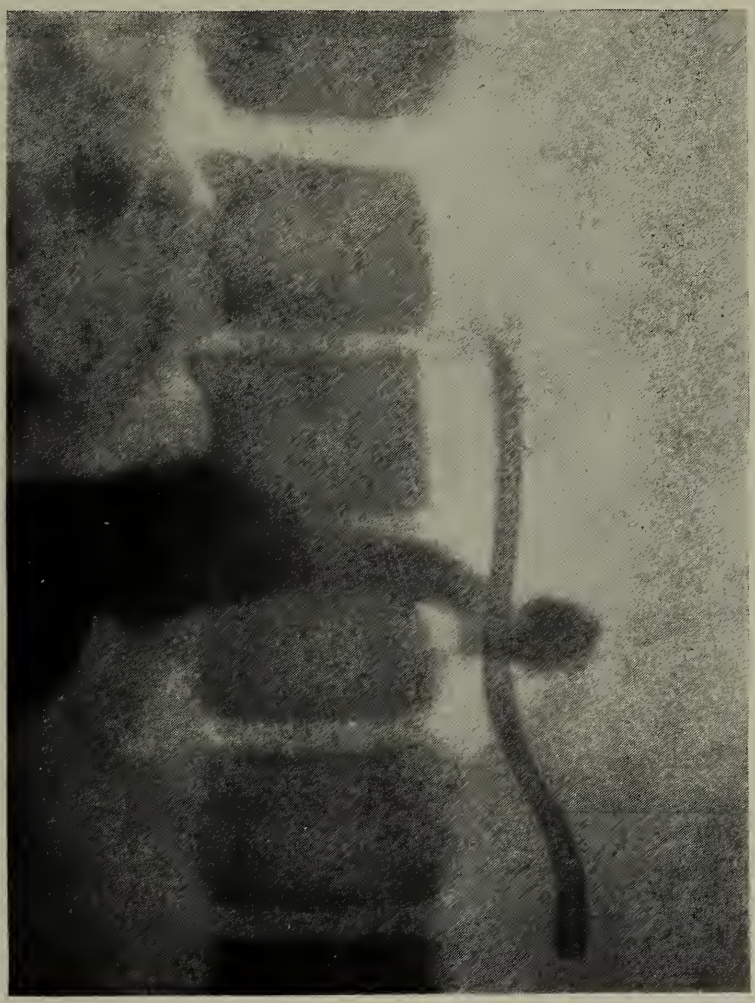
sufficiently to delay its escape until the tract can epithelialize, nor any suggestion of utilizing the "duodenal tug" of every peristaltic wave finally to make it pass off by the bowel. These two factors are, in my opinion, most important to the successful outcome of the most difficult procedures the surgeon meets with.

The ordinary soft rubber catheter with its funnel-shaped end or the soft rubber catheter a demeure trimmed to suit, meets these indications better than anything else I have used. Always at hand and in assorted sizes to meet the individual case, one need not resort to any special device. In the vast majority of cases, the proximal end of the duct is so well dilated that the funnel end, by simple folding on itself, can be inserted proximally and then held there by a chromic catgut encircling suture, the balance of the catheter having been passed previously wholly into the duodenum. The ends of the duct are then approximated as well as possible by sutures and the wound closed with a cigarette drain.

In the few cases in which the repair of the common duct is to be made immediately following the accidental or intentional removal of a segment, the proximal end of the duct is often no larger than the distal end and will not permit the introduction of a cuff or funnel. In Case 5 I was successful in overcoming this difficulty by temporarily anchoring with a single silk thread tied around the catheter, brought out through the incision, and attached to the skin with adhesive. Held thus in place four and one-half months, the tube passed seven weeks after cutting the anchoring thread.

Only too frequently it happens that the obstruction has existed so long it proves impossible to discover the distal end of the duct, atrophic and buried in adhesions and scar tissue. When this is the case, either the method recommended by Walton and by Mayo of a pedunculated flap of duodenal wall con-

taining all three layers should be sutured to the proximal end of the duct and the duodenum, mobilized so as to be sutured well in contact with same. When this cannot be done then with the tube introduced into the proximal end and fastened there as before suggested, the balance of the catheter is inserted in



Same, with bismuth in duodenum.

the duodenum through an opening, previously encircled with a good silk purse-string suture, made in that part of it most easily brought up to the proximal end of the duct. By this means I have twice overcome the difficulty. Pains-taking efforts, however, should be made to find the distal end and only then

abandoned when further efforts would seem to jeopardize the patient's life, because no anastomosis of duct to stomach or duodenum is as free from danger of an ascending infection as is the ampulla of Vater. Two of the cases reported, of the latter type, while showing no jaundice and no clay-colored stools, have had, from time to time, all the symptoms that attend a moderate cholangeitis, chill, fever, malaise, nausea without jaundice or bile in urine; while those in whom it was feasible to utilize the ampulla have been much more free from these disquieting reminders of their old ailment.

Case 2.—Mrs. B., entered St. Luke's Hospital November 1, 1918, for obstruction of the common duct, with jaundice. Reopened the abdomen through old incision for cholecystectomy. No stones palpable in common duct. Pus, blood, albumen, casts (hyaline and granular) in urine. Quick insertion of two tubes at point of probable ligation of former cystic duct where stricture was found and split. One tube was inserted toward the liver in proximal end, and one downwards toward the duodenum, and the wound hurriedly closed, the aim being to relieve cholemia by the simplest procedure. Recovery was good, but there was some intermittent jaundice; itching was gone at the end of the week. One month later still she was somewhat jaundiced.

Second operation December 23, 1918. Fistulous tract injected with methylene blue, and tract followed through adhesions to the common duct. Opening in it was enlarged sufficiently to insert a three-eights inch rubber tube into the duct. On the upper end a cuff or revers had been turned back in order to enlarge its calibre and retard its escape into the duodenum. The tube was about four inches long. The common duct was sutured over the tube at the slit in the stricture. The wound closed with drainage. Wound closed on the eleventh day. Stools became dark and urine light. Discharged 19th day (Jan. 11, 1919).

Case 3.—Mrs. S. May 28, 1918. Typical history of biliary colics, nausea, vomiting, and jaundice. Gall-bladder was drained seven years before, after removal of stones, by Dr. G. Reoperation revealed an hour-glass stricture of the gall-bladder. Compartment at fundus filled with stones below stricture (probable former purse-string site). The gall-bladder was thickened and infil

trated. The cystic duct was ligated with artery and vein, and cholecystectomy made. The drain was inserted down to the stump. There was free flow of bile on second day. The wound healed, and the patient was discharged July 23, 1918.

December 1: The patient was sent to the hospital with a chill, and fever; leucocytes, 15,400, pulse 100, temperature, 102/4°, urine highly colored; stools light colored. The temperature was normal on the fourth day and the patient was discharged on December 7, 1918.

February 11, 1919: The patient returns to the hospital with jaundice, nausea, and vomiting; pruritus.

Operation: The abdomen was opened through the old scar. The common duct was identified and opened. The probe passed downward easily into duodenum without obstruction; passed upward to meet the obstruction near the hilus of the liver. The duct was split upwards along the probe to the obstruction, due to connective tissue constriction and scar tissue. A portion of a small No. 7 soft rubber catheter was inserted with funnel, and was inserted above the constriction, and the other end was passed down into duodenum and then closed over catheter, and a Bullitt drain inserted to the field of the suture. Drain was removed on the seventh day. February 18: stools normal on the second day. The patient returned home, healed on March 3, 1919.

After one and three-quarters years of comparative comfort, the patient again showed jaundice. On December 14, 1920, the abdomen required reopening. The common duct was reached through the adhesions without seeing free peritoneum. Opening the same revealed a black-silk suture as the nucleus of a gall-stone at site of former stricture. It was deemed advisable to suture the proximal end of the common duct to the new opening inside of the duodenum. This was done by inserting a purse-string suture in the duodenal wall, passing nearly the whole catheter down the duodenum through the small button-hole incision and tightening the purse-string suture. The funnel end was inserted in the proximal end of the common duct above the stricture, and the common duct end was sutured to the duodenum by four fine silk sutures. A drain was inserted to the bottom of the wound and removed on the seventh day. The patient was discharged on December 30. Tube passed the twenty-seventh day.

Case 4.—Mrs. M., December 30, 1912, aged 29, married. The patient was operated on ten months ago for gall-

bladder disease; then again six weeks later. For four months there were intermittent jaundice, pain and vomiting, and the stools were clay colored. Stricture of the common duct was found, and opened. A tube was inserted with the cuff turned back for the proximal end; the other end was carried down into the duodenum; the duct was sutured over it; the wound was closed with drainage. Recovery was prompt, with relief of symptoms. The tube passed in nine weeks.

Case 5.—Patient aged 30, married, two children. There was frank gall-stone disease, associated with occasional jaundice. No previous operations. Operation on June 9, 1921 at St. Luke's Hospital. The simplest type of cholecystectomy was done, following the best known technic of subperitoneal resection of the cystic duct after satisfactory isolation and identification of both artery and duct. I never did a more comfortable, easy cholecystectomy. There were many stones. After the wound was closed and the patient was in bed, inspection of the specimen showed a peculiar one-quarter inch tubular structure attached to one side of the cystic duct portion of the gall-bladder. Immediate frozen section showed it to be lined with epithelium similar to the duct. I immediately realized my mistake, told the family physician, who had watched and complimented the careful operation, and the relatives frankly what had happened and explained the necessity of immediate opening of the wound to re-suture the duct. This was done. The ends of the duct were picked up and the catheter was passed down almost entire into the duodenum through the distal portion. Inasmuch as there had never been any dilatation of the common duct, it was not feasable to insert upwards the funnel end of the catheter, so the funnel was amputated, and the cut end passed up to the liver. In order to anchor it in place a medium sized wax silk ligature was tied to the catheter at the area uncovered by the duct and anchored to the surface of the skin by adhesive plaster; then the ends of the ducts were approximated toward one another to within half an inch. The wound was sutured. Some bile discharged until the anchor thread was cut four and one-half months after operation, September 14. The catheter passed November 7, 1921. The wound ceased leaking in ten days after the thread was cut. The patient was then apparently perfectly well. See x-ray chart of catheter in situ.

Case 6—Patient E. C., the operation was done by my house surgeon, I assisting, by the above technic and reported in Elliott's group.

Dr. Arthur E. Hertzler, (Kansas City, Mo.): I did a little stunt recently which, so far as I know, has never been done before.

Let us say, for instance, this is the hepatic duct (illusrating on blackboard), with the common duct at this point. The cystic duct and gall-bladder are up this way (indicating), and the point of obliteration is down here. The cystic duct was somewhat dilated. I used this much of the gall-bladder, ligated the artery up here (indicating), and turned this thing down, making a roof for the lower half of the duct by covering it with part of the gall-bladder and putting in a tube from this point down into the duodenum, and another one above. I have tried this in one case, and in that particular case up to date the method has worked very well. I do not see any reason why we should not use the gall-bladder for the construction of a duct wherever it is needed. Of course, if the gall-bladder has previously been removed, you have not any tissue. Just how well that would work if the artery had already been cut or does not come in contact with the gall-bladder at a sufficiently low point, I do not know, but I believe the stump would receive nutrition if you ligated the artery lower down.

Dr. Allen B. Kanavel, (Chicago, Ill): I have prepared the duct in one case by the method Dr. McArthur suggests. In that case I anchored the tube by very fine silk, and it came away in two and a half months with a prefect result.

I should like to draw attention to the fact that in these cases there is more or less jaundice for months. They have liver changes and are not in a condition to stand operation nearly as well as other patients, and we should be very careful to give these patients calcium-lactate treatment and do a blood transfusion at operation if we are going to save most of them.

Dr. M. L. Harris, (Chicago, Ill.): I think we have all been put to our wits' ends at times to correct cases of this kind. I should like to mention one case where I tried a procedure which was very satisfactory and very simple to do. A biliary fistula coming to the surface, as we all know, will be lined by epithelial cells eventually. Just how long it takes to line the whole tract I do not know, but we know the fistula will be lined finally. It will not close, as the tract lined by epithelial cells does not contract.

I recently operated on a woman who had had the hepatic duct cut off quite close to the liver. It was not my case originally, but the doctor who had the case told me that the duct was cut off close to the liver. Some months later I made the repair. I made an elliptical incision around the fistulous tract through the skin and through the abdominal wall, and turned the little fistulous tract into the duodenum. The fistulous tract which had formed on the undersurface of the liver has remained patulous. The operation was simple; it took very little time to turn the fistulous tract into the duodenum, the wound closed, and the bile went through into the intestine.

Dr. McArthur, (closing): Dr. Hertzler was probably not present when I spoke of not including in the paper consideration of the class of cases which involved utilization of the gall-bladder, the stomach, or duodenal wall, and I briefly referred to the gall-bladder utilization.

I want to say that one case of utilization of the gall-bladder-duodenal anastomosis for the correction of an icterus, due to carcinoma at the head of the pancreas, afterward resulted in the very prompt death of the patient in three days due to the involvement of the bile tracts with the Welch bacillus. A post mortem was made, and no leakage was found from the line of union from the duodenum and gall-bladder end, sutured as we do a gastro-enterostomy with a row of sutures, but there was a liver three to four times its usual size from gas infiltration. The Welch organism is to be feared in any anastomosis we make—whether from the gall-bladder or from the stump or proximal end of the duct into the duodenum; these organisms are frequently present and may be contributing factors.

Dr. Kanavel's suggestion is a timely one, that we should not try to do a major surgical operation on patients who have been icteric for two or three or six months, but we should help them get over the jaundice, and that I did in the first case I reported in detail, so that the patient was not profoundly icteric when I made the second operation.

The utilization of calcium lactate is certainly desirable, and it can be used in stronger solution intravenously to get the early effect of it. The horse serum I usually give when I fear there may be hemorrhage in the icteric.

Dr. Murphy made a very early recommendation of the utilization of the fistulous tract dissected from the skin down to the duodenum and is entitled to priority for the

recommendation of it. Unfortunately, the cases reported since then have cicatrized so that they fail to work. They worked for a time, but those reported in the literature have resulted in cicatricial contraction and finally with recurrence of the symptoms. Personal efforts to utilize Murphy's suggestion proved impossible because most frequently part of the fistulous tract is composed of colon or duodenal wall which cannot be dissected loose to make a tract.

CHOLECYSTOSTOMY OR CHOLECYSTECTOMY—WHICH?

MILES F. PORTER, M. D., F. A. C. S.

FORT WAYNE, INDIANA

Is the question that forms the title of this paper a pertinent one? Has the gall-bladder a function or functions to perform that are of importance to the economy, or is it a practically useless and more or less troublesome appendage to be treated by the surgeon as is the vermiform appendix? Upon the answer to this question should depend, in large measure, the surgeon's treatment of the gall-bladder. In a former paper[1] the writer presented evidence which seemed to establish the fact that the gall-bladder in man is an important, though not vital, organ. In addition, your attention is here directed to the experiments on animals made by Rous and McMaster,[2] which experiments proved that the "concentrating activity" of the gall-bladder was a function indicating that it was an organ of "special importance to the organism." Robson[3] recently emphasizes the importance of the reservoir action of the gall-bladder and says that "sufficient time has not yet elapsed to show whether the liver is injuriously affected by this pressure (after cholecystectomy) and absorption." "Whether cirrhosis of the liver and pancreas will result in a certain number of cases remains to be seen," Rous and Larimore[4] found by experiments that both monolobular and diffuse intralobular cirrhosis was produced by ligation of the common duct. Flexner's experiments prove that when pure bile is injected into the pancreatic ducts it produces pan-

creatitis, but when the bile is mixed with mucus before injection it is harmless.

R. C. Fravel[5] reports a series of cases of cholecystitis with and without stones, in a large percentage of which there was hypochlorhydria. He says "whether the gall-bladder has a function or not the effect of its removal must be decided before we can dogmatically say that all diseased gall-bladders should be removed." This author also refers to Holweg's[6] observation of 42 cholecystectomized patients suffering from gastric symptoms, in 83.3 per cent of whom hydrochloric acid deficiency was found, and his statement that a similar phenomenon followed cholecystectomy in dogs. He quotes other observations of like import and suggests that the acid produced in the stomach may be an index of the function of the gall-bladder, and he advises against the removal of the gall-bladder in those cases in which, from the acid content of the stomach, it seems capable of functioning.

It is contended by some that the value of a functioning gall-bladder to the economy is not great enough to warrant the leaving of those even possibly dangerous. Says one, "the recurrence of gastric symptoms after cholecystostomy usually means that the gall-bladder should have been removed." My own opinion and experience is not in accord with this. On the contrary, my experience has been that continuation of symptoms after cholecystostomy means, in the majority of instances, either (a) overlooked or new-formed stones, (b) cholangitis, (c) ulcer of the stomach or duodenum, or (d) pancreatitis. Now and again one finds in the literature a case wherein symptoms attributed to gall-bladder disease were found to be the result of a diseased appendix; however, the more frequent error consists in accusing the appendix when the gall-bladder is the real culprit. The deductions made by many of those who champion the cause of cholecystectomy as against

cholecystostomy are frequently fallacious. One finds, for instance, a large number of cases reported purporting to prove that cholecystectomy frequently relieves cases wherein cholecystostomy failed. In the majority of these reports a careful analysis of the individual cases will show in many of them that when the 'ectomy was done, a stone or stones were also removed. Such cases emphasize the necessity for painstaking work and have little or no bearing on the matter at issue. Jacobson,[7] in his paper on the gall-bladder work done at the Peter Bent Brigham Hospital, reports five secondary operations for overlooked stones. In four of these cases the primary operation was a cholecystectomy. In Jacobson's series of cases (397) "A normal gall-bladder was removed in sixteen." Five of seven of these patients who were traced reported that they were "unimproved or in worse condition than before the operation." This report of Jacobson illustrates the dangers of an overweening faith in cholecystectomy consequent upon an unwarranted suspicion of the gall-bladder as a power for evil and an equally unwarranted belief in its uselessness. In a clinic manned by men believing that the gall-bladder is an important organ the bellies of these patients would have been closed perhaps after providing for drainage of the gall-bladder, and the search for the real trouble continued at once on development of the fact that neither the gall-bladder nor bile showed any pathology. This report seems to me also rather to prove the danger of routine operations in general and emphasize the force of Eastman's statement[8] that "It is mischievous to take out a gall-bladder simply because it is an attractive operative procedure." If we had to deal with an infection of the gall-bladder alone, this would be a very easy question to solve; but I have never seen a badly infected gall-bladder that was not associated with infection of the ducts or with infection of the pancreas. I believe we shall decide more and more to utilize the gall-bladder for drainage in such cases than to lead

to the conclusion the writer reaches, namely, that "cholecsytectomy is the operation of choice in cholelithiasis and cholecystitis whenever feasible." Evidence is rapidly accumulating which seems to show that infection of the gall tracts usually commences in the liver.[9] This evidence minimizes the force of the argument that removal of the gall-bladder is an important factor in the cure of cholangitis and its results, and emphasizes the value of drainage. I am firmly convinced in my own mind that the cures which have followed 'ectomy in cases wherein 'ostomy failed except those wherein additional stones were found, are to be explained, many times, on the basis of the drainage consequent upon the 'ectomy with its resultant dilatation of the common duct and paralysis of the sphincter of Oddi, and not to the fact that a nidus of infection (that is, the gall-bladder) was removed, or to the fact that "only serious contractile force in the biliary system has been cut out," as held by Archibald.[10] Another argument advanced in favor of removal of the gall-bladder is that a diseased gall-bladder after drainage probably does not regain its power to function normally. This argument is refuted by the fact that numerous gall-bladders have been examined after 'ostomy and found normal, while there are recorded many hundreds of patients entirely free from gall-bladder symptoms following this operation. Personally, I never knew an acute cholecystitis that failed of a cure from cholecystostomy, unless a stone had been overlooked, save one. This exceptional case was one of acute cholecystitis and cholangitis with jaundice. The drainage was not kept up as long as it should have been. Soon after it stopped there was an acute return of symptoms, including jaundice. A second operation was refused, death ensued, and at autospy the common and hepatic ducts were found to contain pus and masses of grayish inspissated mucus. W. J. Mayo[11] says "A seriously infected gall-bladder cannot exist without evidence of infection in the glands which drain it," and that in such cases as fail

to show the ordinary signs of infection "the mucosa will, if examined, show unmistakable evidence of chronic infection."

Now and again a typical gall-bladder stone will be the only physical finding lending color to the clinical picture of chronic cholecystitis. Yet, again, even this positive evidence may be absent, and we have left only the appearance of the mucosa and the divided walls of the gall-bladder to depend upon. Supposing all these signs fail, shall we remove a gall-bladder on the clinical symptoms alone? It is not denied that a gall-bladder may be infected to a degree requiring its removal and yet there be no signs of such infection that can be detected by the unaided senses; but I have never had such a gall-bladder demonstrated to me, and until I have I shall remain skeptical, and continue to drain such gall-bladders rather than remove them.

SUMMARY

Routine removal of the gall-bladder is based upon the following assumptions:

1, (a) That the gall-bladder is an unimportant organ, and (b) its removal is followed by no untoward results.

2, That all gall-stones have their origin in a "primary cholecystitis"[12] and that recurrence or continuation of symptoms following 'ostomy is usually due to the fact that the gall-bladder was not removed.

The facts are as follows:

1, All evidence at hand supports the contention that the gall-bladder is an important organ, and evidence is not yet at hand to warrant the conclusion that its removal leads to no serious consequences.

2, Cholecystic disease including gall stones frequently if not usually originates in the liver. Routine

cholecystectomy frequently fails to cure and leads to the removal of healthy gall-bladders in over 4 per cent of cases.

CONCLUSION

The gall-bladder should not be removed unless it has been rendered useless or dangerous by disease.

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DISCUSSION

Dr. Jabez N. Jackson, (Kansas City, Mo.): This question is one of real interest and one that has not been solved, and I believe we can solve the question finally if we can determine in the individual case the actual source or sources of the infection or what type of infected gall-bladder we have to deal with. As a matter of fact, I am convinced that we have two different types of cholecystitis in the region of the infection, and I wish to refer, briefly, to the results of surgical treatment of these types.

There are certain types of infected gall-bladder in which I am satisfied that we probably have a surface infection or contact infection. We used to think probably that in some of these cases the infection is an ascending one from the duodenum, and probably there are some cases that belong to that class, although probably not most of them. It is a clinical fact that we not infrequently find the co-association of chronic infection of the appendix and chronic infection of the gall-bladder, and when we consider that every bit of blood of the whole digestive tract passes through the liver, which is the great filter of the body, we can understand why infections beginning in the appendix may be filtered out in the liver, thrown into the

bile and in the circulation of the gall-bladder, and thus have similar surface infections. On the other hand Rosenow of the Mayo Clinic, in his studies, speaks of a certain affinity of bacteria for certain organs and has demonstrated the fact that an infection from the gall-bladder introduced into the guinea-pig (the experimental animal) will locate itself in the gall-bladder in 80 per cent of the cases. These infections never become surface infections. These were hematogenous infections through the blood vessels. We may have, primarily, an interstitial infection. It is quite probable that in many instances you may have mucosal infection in which the infection invades the interstitial walls of the gall-bladder and likewise an infection that begins as an interstitial infection, and in which later on the mucosa is involved. The probabilities are that in the pure type of cases the infections are interstitial and are of that type involving gall-bladders in which there are no stones at all. There may be gall-stones present without any visible evidence of any interstitial change in the structure of the gall-bladder. I am pretty well satisfied that if I remove gall-stones and drain the gall-bladder I shall bring about a cure. On the other hand, if there are gall-stones plus a white gall-bladder with interstitial changes, drainage will not cure that type of case. Again, I am satisfied that in cases of chronic cholecystitis without gall-stones drainage will not cure any of them.

Dr. Byron B. Davis, (Omaha, Neb): When we have an inflamed appendix we remove that appendix, not simply because of the fact that it is inflamed, but for other reasons. We should look upon that appendix as a sort of infective focus, from which other infections are likely to arise, and we know this infective focus as Dr. Jackson has just said, very often involves the gall-bladder as the next step in the infection. I think we are overlooking the work done by Dr. Graham, of this city. His demonstration of the fact that infection of the gall-bladder occurs, not as a hematogenous infection, but as an infection through the lymphatics connecting the liver with the gall-bladder, is probably the correct explanation. So I am very much inclined to think that many of these cases occur as a lymphatic infection from the liver. In most cases of cholecystitis I do not believe we have simply a surface infection. In very few of the gall-bladders I have examined has the infection been confined to the mucous membrane. In almost all of these cases the submucous and muscular coats are involved more than the mucous membrane, and when we drain the gall-bladder for a few days we perhaps may improve that surface infection, but we are not getting rid of the infected gall-bladder. We still have the cho-

lecystitis after the drainage is over. It has long been my feeling that cholecystitis should not be treated simply as an infected gall-bladder, but also because of its influence over the upper abdominal organs. I think it is well understood that there is no question that a very large proportion of these cases of cholecystitis have associated with them a hepatitis. It has also associated with it, in very many cases, pancreatitis. How much it influences the development of ulcer of the duodenum and stomach I am not certain, but it is a great deal bigger factor than has been considered in the past. That being the case, it seems to me when we employ drainage of the gall-bladder it is illogical because we are not removing the disease; we are temporarily palliating the trouble and not getting rid of the real pathology.

In my own experience I have drained as many gall-bladders as I have removed. I went over my cases as far as I could only a few weeks ago, and found I had many times as many cases that came back with symptoms after drainage as after removal of the gall-bladder. It has been my experience in at least fifty cases to have to do cholecystectomy after first having done cholecystostomy without getting rid of the symptoms. By the way, the last case I had yesterday before leaving home was to remove a gall-bladder which had been drained over two years ago without relief of the symptoms. I conceive that a healthy gall-bladder is better than no gall-bladder, but a pathologic gall-bladder should be removed. Cholecystectomy should be done in practically all of these cases.

Dr. Willard Bartlett, (St. Louis, Mo.): This discussion is becoming so complicated that one hesitates not to keep quiet and not further complicate it. After hearing many such discussions, one comes to the conclusion that it really does not matter very much in many instances which one does. An old teacher of mine, when we graduated, advised all of us to get married, saying you will be sorry if you don't, and after waiting a little while he added, you will be sorry sometimes that you did.

To be a little less facetious, there are arguments on both sides in many instances, so I am beginning to believe it is hard to say offhand whether or not we should remove the gall-bladder in a given case after weighing all the arguments on both sides. It seems to me we should not pass the whole subject without going farther back to the fundamental matter of trying, if possible, to find and treat the original focal infection, from which surely a

great many of these diseased gall-bladders must come. Why go on and leave the original thing, whatever it may be, to damage joints or to cause some one of the other well-known secondary conditions.

I know of the specificity of streptococci, which has been urged, but Rosenow's experiments have not been repeated with 100 per cent good results by other people. You can reason it out to suit yourself, but, at any rate, we are not safe in concluding that the gall-bladder is the only thing damaged by the original focus.

Another thing. To further muddy the water, I should like to call attention, respectively, to the fact that chronic inflammatory manifestations in other tissues and organs clear up in the course of time to an extent that it is very hard to say whether an old hand that was edematous and infiltrated for a long time was ever sore or not excepting for the marks of surface scars. After a while edematous tissues clear up, and you cannot tell whether they were edematous or not.

On a few occasions, in opening the upper abdomen the second time to see a gall-bladder that was drained long ago, I will say that when originally seen the gall-bladder was thick walled, stiff-walled, white, and, when seen years later, could not be told ordinarily from a normal gall-bladder. The wall of the gall-bladder was thin and blue; restitution had taken place; and it did not look as though it had been inflamed at all. Why jump in with a rush in these cases? I do not consider it a good reason for removing a gall-bladder merely because you found it at one time in a thick, white, stiff condition, when we know that by more conservative measures, which we resort to in the subacute or acute cases, the gall-bladder may change for something distinctly better and for something that is more or less normal. I will admit we are sailing between Scylla and Charybdis. I have taken out a gall-bladder years after draining it and have had the patient clear up, but I have also had the experience of having taken the gall-bladder out, of having common-duct bile and new stones form in the common duct where there were none before, and no symptoms of common-duct disease before. The thing is getting harder and harder to decide, and ordinarily, except in cases in which the indications are marked, it is quite safe to do one operation or the other. I do not take out the gall-bladder myself a great deal, and we are getting into trouble, no matter which we do.

Dr. Evarts Graham, (St. Louis, Mo.): It seems to me discussions on gall-bladder infections nearly always get

focussed on too small a point. The real consideration in gall-bladder surgery is that which concerns the most important organs involved, and these are always the liver and pancreas. Both the liver and the pancreas are vital organs in the sense that we cannot live without either one of them. Comparatively speaking the function of the gall-bladder is insignificant in relation to that of the liver or pancreas. The reason why gall-bladder surgery is important, therefore, is because it is very essential to conserve the functions of the liver and pancreas. There is no doubt that the normal gall-bladder has a function, but the question that should arouse our attention is rather, is the function of the gall-bladder so important that we should attempt to preserve it in a diseased condition when by doing so we may irreparably damage the liver and pancreas?

The fact that in some cases of cholecystitis the patients recover after simple drainage, it seems to me, should not influence us too much in a discussion of the advantages of cholecystectomy over a simple drainage. We know that many cases of appendicitis recover spontaneously. There is no question about that. Should that deter us from taking out a diseased appendix? By no means. But it may be said that that is a different situation because the appendix has no appreciable function; that we can get along without it. But how are we going to tell in a particular case of cholecystitis whether the liver and pancreas are going to be seriously damaged?

Again, I desire to call attention to the fact that the discussion here, as I take it, is not about the removal of a normal gall-bladder, but of a diseased one. Discussions, therefore, on the functions of the gall-bladder are important only in so far as they tend to put the brake on extirpations of gall-bladders which are not diseased. Surely, there are many cases in which we do not get satisfactory results after cholecystectomy, but I am not sure by any means that this is always due to the loss of the gall-bladder. In fact it seems very probable that in many of these cases it is the damage to the liver and pancreas which is responsible for the symptoms and that perhaps the gall-bladder has not been removed soon enough. A vicious circle may arise by way of the lymphatics between the liver and the gall-bladder, which can be demonstrated experimentally. There is an abundant communication of lymphatics which go in both directions between the liver and gall-bladder. We have demonstrated experimentally that a cholecystitis will produce a hepatitis and, vice versa, that a hepatitis will produce a cholecystitis. Injections of

pathogenic organisms into a radicle of the portal vein will also produce an interstitial pancreatitis. Apparently the best way of breaking the vicious circle beween the gall-bladder and liver is by performing cholecystectomy.

In the last few years we have been considerably interested in this subject, and as a routine we have been taking pieces of liver for microscopic examination in cases of cholecystitis, and we have never yet failed to find a very marked amount of hepatitis present, which is easily demonstrable microscopically in varying degrees, depending upon the extent of the cholecystitis. To my mind the important thing is to concentrate our attention on the liver and pancreas, and not on the gall-bladder. It is the function of the liver and pancreas that is important. If we remove a few gall-bladders too many, with the result that there are certain distressing symptoms that remain, those symptoms are not anything in my mind to be compared with the serious consequences which may result from damage to the pancreas and liver as a result of leaving in a gall-bladder which ought to come out.

One other point in regard to the remarks of Dr. Jackson, who spoke of two types of cholecystitis, one of which I gather from his remarks is limited to the mucosa. He says it is a contact infection. The other type is an interstitial infection which he states goes through the blood stream, according to the explanations advanced by Rosenow. We have examined microscopically a considerable number of gall-bladders removed at operation, and we have not yet found the inflammation limited to the mucosa. We have also in different series of animals—dogs and rabbits—attempted experimentally to produce cholecystitis by contact infection, namely, by the injection of bacteria into the lumen of the gall-bladder, and have not succeeded in doing that unless we ligated the cystic duct or artery. This result has also been confirmed by a considerable number of other people, so now, at least, in a series of animals it is considered almost impossible to produce a cholecystitis merely by contact infection. The same thing holds true of the human being and seems to be illustrated by typhoid fever. In typhoid fever, according to the pathologists, at least, bile always contains swarms of typhoid bacilli, yet how rare is cholecystitis in the course of typhoid fever. Osler states that in a series of 1,500 cases of typhoid fever under his observation in the wards of the Johns Hopkins Hospital, only 19 developed clinical evidence of cholecystitis. Rolleston puts it lower than that, notwithstanding the fact that generally during this time the bile is literally teeming with virulent typhoid

bacilli. If contact infection of the gall-bladder were easy to produce, we would expect every case of typhoid fever to have cholecystitis, yet it is very rare during the course of typhoid fever.

Meyer, at the University of California, recently in an exhaustive article on typhoidal cholecystitis shows by autopsies made on human subjects and also on animals that it is essential, first of all, to have a definite inflammatory lesion of the liver before a cholecystitis occurs in the course of typhoid fever. Now, if there is a definite inflammatory lesion of the liver, why should not the infection there spread just as it does in any other part of the body, just as it does in the hand or foot for example, spread largely through the lymphatics? There is an abundant lymphatic anastomosis between the gall-bladder and liver, and the lymphatics of course do not strike the mucosa, but strike the wall of the gall-bladder. There may be produced, therefore, an interstitial infection of the gall-bladder. If we have a definite hepatitis, we may expect in the majority of cases to have cholecystitis spread from the liver to the gall-bladder by way of the lymphatics.

Dr. Porter, (closing): I do not believe that there is a great deal of difference between my view and the views of those men who have spoken. My contention is simply this, that a gall-bladder that is chronically diseased should be removed, but that to remove a gall-bladder because you have made a diagnosis of gall-bladder trouble and cannot verify it by going into the abdomen, in my judgment is bad surgery. At the Peter Bent Brigham Hospital they have removed over 4 per cent of normal gall-bladders. For the sake of argument, we will say that operation does not do any harm, but even if it does not do any harm, why allow these people to remain in the hospital and pay their expenses for two or three weeks and wait until they send a report back to the hospital that they are no better, or are even worse than they were, before beginning to find out what is the matter with them. If you go into that abdomen, bear in mind, if you please, the admonition Oliver Cromwell to the Scotch Parliament, when he said to them, "In the name of God, consider it possible you may be mistaken." That is the attitude for the surgeon to have when he gets into the belly.

When Dr. Graham says the removal of the gall-bladder does not lead to harm, he does not know any more about it than I do. We have no adequate evidence as yet to enable us to settle this question. As Robson says, that is an unsolved problem. We should remove a gall-bladder

if its removal is required, and it is required in all cases of chronic interstitial cholecystitis, in cases of strawberry gall-bladder, and all that sort of thing. In these cases often on opening the abdomen, notwithstanding our diagnosis, we find a gall-bladder that looks normal on the outside—normal in color; the bile it contains seems to be normal, and when it is opened up it presents a normal coat. I think in these instances it is better to conclude that the gall-bladder is normal and be satisfied to be on the safe side by putting in a drainage tube and not wait for a patient to get out of the hospital. We should make up our minds that we have made a mistake in diagnosis and do what further developments of the case seem to demand.

THE ACUTE TRAUMATIC BELLY

T. C. Witherspoon, M. D., F. A. C. S.

BUTTE, MONTANA

I have chosen for a brief discussion in this paper cases of acute traumatism of the belly, gunshot and knife wounds being excluded. Whether a surgeon is engaged in industrial surgery or in private practice only, he may be required at any time to care for and act promptly in the relief of one of these cases. They are, therefore, of perennial surgical interest.

The time limit of this paper will necessitate a very brief review of the subject, and that which I shall say necessarily relates largely to a personal experience. As our activities are in a large industrial center, it might be thought there is brought to us the majority of the patients from mines and smelters. That this, however, has not been the case will be seen from the record. Six out of the seventeen cases which we record were due to injuries wholly unrelated to industrial activities. The cases which we wish to report are those which have come under observation within the last two years. There are seventeen in all. An abbreviated tabulation of them is given in Table 1.

Concerning the etiology and mechanism of injury in cases of subcutaneous rupture of bowel and intra-abdominal injuries, much has been written. The oldest theory, I believe, considered intra-intestinal pressure as the most important factor. Von Languet (1875) was the first to show experimentally that the

real factor was the actual crushing of bowel at the time of trauma. Curtis, in 1887, with further experimentation considered that "the intestine is ruptured by being crushed between the contusing body and the bony parts, chiefly the vertebræ and pelvis, and that there are many chances in favor of the escape of the intestine from injury."

The usual classification one sees of intestinal rupture is that suggested by Moty: (1) crushing type; (2) tearing type; (3) bursting type.

The majority of cases are those of the first type, in which the essential mechanism is a crushing injury to the bowel, the result of an external force being directed toward the abdomen and pressing bowel against the fixed bony points, that is the vertebræ. While the mechanism of the injury is essentially the same in every case, the character of the injury is influenced by many factors:—the character of the contusing force, as well as the nature of the contusing body, whether it is blunt or sharp; the velocity of the offending force; the direction of the impact,—all vary in each individual case. Of equal importance is the condition of the individual receiving such injury. The protection of a rigid and well-developed muscular abdomen is well known; likewise the advantage of a heavy panniculus, and, on the contrary, the lack of protection afforded by a lax abdominal wall is often demonstrated. This fact has not only been amply shown in cases of actual injury, but has been demonstrated experimentally on dogs by Eichel. The presence of a distended or a full bowel is also a most detrimental condition, favoring as it does, rupture.

There has been no unanimity of opinion as to what particular portion of the abdomen might be called "the dangerous area." Makins found evidence of injury below the umbilicus in eight cases out of nine with rupture of the small bowel. Moynihan has said that the portion of the abdomen below the umbilicus

may be appropriately called the dangerous area. Others, notably Moty and Cahier, believe the zone of greatest danger is at and above the umbilical level. The exact point of external injury is very apt to be overlooked from the fact that its appearance is often delayed until the second or third day. In cases which have undergone exploratory laparotomy, the dressings conceal this information.

Although the preponderance of cases reported are injuries below the umbilicus, there are sufficient numbers of cases occurring with supra-umbilical injury to warrant the inclusion of that area in the so-called danger zone. In any event the exact location of the external injury cannot be considered as much of a determining factor as can the condition of the abdominal musculature and the underlying bowel at the time of trauma. These two things, along with the character and velocity of the contusing agent, are the essentials in the mechanism of this type of injury.

The second type of rupture, the so-called tearing type (dechirure) is much less frequent in its occurrence. The etiological factors are practically always the same: (1) a fall of some distance, landing on feet or buttocks; and, in conjunction with this, (2) a full bowel and a relaxed abdominal wall, causing a marked diminution of intra-abdominal pressure at the time of trauma. The usual site of injury in these cases is a tearing at a point of some fixation.

The third type is the bursting type. This injury is a surgical rarity, and, therefore, in passing, suffice it to state the mechanism has not been satisfactorily explained. An isolated loop of bowel may be temporarily distended with an application of external force in such a manner as to cause a rapid increase in tension and a resultant rupture.

Another type of injury which may well be considered is the so-called pneumatic rupture of bowel. Through the universal use of compressed air this type of injury

is becoming more frequent. Since the publication of the original paper of Andrews, in 1911, explaining in detail the mechanism of injury by passing compressed air through the rectum, several other cases have been reported. This accident is practically always the result of a joke; the perpetrator is entirely ignorant of the serious consequential results. The frequency of these cases would seem to warrant some form of caution being given in the places where compressed air is accessible. One interesting point which we observed in one case, and which has been previously noticed, is that heavy clothes do not offer protection against the impact of the air; secondly, that it is not necessary for the nozzle of the compressed air hose to be in immediate proximity to the rectum.

The correct interpretation of symptoms in cases of abdominal injury is at times confusing to the most expert. In the late cases in which a frank peritonitis exists, the symptoms are classical and the course to pursue is at once apparent. The early cases, however, present a perplexing problem, a problem of paramount importance in which prompt recognition of intra-abdominal injury means early operation and early operation means a lower mortality.

SYMPTOMS AND DIAGNOSIS

A review of the literature impresses one by the multiplicity of symptoms mentioned, each author placing some peculiar value upon a single symptom in conjunction with others in the diagnosis.

Homer Gage wrote, "I should regard muscular rigidity as the most important symptom of all, particularly if at all definitely localized." W. J. Mayo believes that "the continuance of rigidity is sufficient to warrant operation in a doubtful case." Mauclaire and Roger also believe the injury to be serious when the muscle spasm and tenderness rapidly become general over the abdomen and do not remain confined to

the area of injury in the early hours after its occurrence. Perez emphasizes the value of continued rapid and superficial breathing. Makins has described a fixed area of deficiency in resonance in cases of perforation. Lexer places special stress upon vomiting of bile. Stanley emphasizes two signs,—cutaneous hyperesthesia and tenderness in the left flank. Cope places pain at the head of the list of important symptoms. LeConte believed the two most reliable symptoms are gradually increasing rigidity and facial expression. Claybrook, in an original article, in 1914, described a new sign,—the transmission of heart and respiratory sounds so that they could be heard over the entire abdomen, as well as on the chest. He stated it might appear as early as one-half hour following injury and believed it to be due to peritoneal irritation and not to the transmission through fluid. Moynihan has also indicated the value of this sign. More recently De Quervian (1917) described an early sign of intestinal perforation,—the demonstration of a circumscribed area of tympany by percussing the upper abdomen, the patient in supine position, and shifting of the area to the left hypochondrium with the patient in the right-lateral position.

This varied group of symptoms and signs, each of some singular value in its author's opinion, emphasizes the fact that there is no one symptom or group of symptoms that proclaims an unerring diagnosis. In many cases there is one symptom or sign that stands out above all the others and in that individual case throws the balance in favor of immediate operation. It may be an increasing pulse-rate or persistent vomiting, or, in another, a continuance of muscular rigidity, etc. In other words, each case of intestinal injury is a different study.

A knowledge of the preliminary facts of the injury is all essential, as previously given under discussion of the etiology. When first seen the patient usually complains of pain; he shows evidences of shock in

varying degrees. An examination reveals muscular rigidity and tenderness; the pulse may be normal, slightly elevated, or rapid, depending upon the severity of the injury. Vomiting may be present early and may be persistent. Respiration as a rule is increased in rate and is more shallow than normal. From our own observations, probably the most constant symptom would appear to be abdominal pain. Pain as a rule, is severe and persistent, often localized at the point of injury. There are, however, special cases in which pain is practically nil. Some time ago we had a patient walk into the clinic, giving us a history of a sharp, sudden blow upon the abdomen by a pinch bar. He was, however, not suffering from shock and not complaining of pain, and felt so well that he refused to remain in the hospital for observation. He returned, however, the following day, fourteen hours later, with definite symptoms, and beginning peritonitis, and operation revealed ruptured jejunum.

That pain may be atypical in its distribution following abdominal injury is also a fact. A case under our recent observation showed the symptom complex, highly suggestive of a perforating gastric ulcer with a sharp, very severe pain radiating to the left chest and shoulder. An exploratory operation showed a large intraperitoneal hemorrhage, and later a history of an abdominal blow was admitted by the patient. Abdominal rigidity in many of these cases can be characterized only as board-like. This holds true for cases of intraperitoneal hemorrhage, as well as for cases of intestinal rupture. Shock is more often present in severe injuries and particularly crushing injuries, often connected with more complicated lesions. It is noticeably absent in some cases and we have seen repeatedly cases with a full pulse and very little evidence of shock. In two of our recent cases with an abdominal injury, the bowel and mesentery protruding from the wound, the pulse was 70 and 68, respectively. In one case of serious intraperitoneal hemorrhage the pulse upon admission was only 58, rising, however, to

100 within twenty-four hours. Vomiting occurred in less than 50 per cent of our cases, and in only one case was it of bilious character. Hematemesis occurred in but one case, that a ruptured stomach. Persistent vomiting was the outstanding symptom in but one case, which operation proved to be intraperitoneal hemorrhage without rupture. We have found peristalsis present in over 50 per cent of our cases. We have repeatedly noticed the sign of Claybrook and believe it is a most helpful diagnostic point. The white blood counts have varied from 6,000 to 43,000; in cases of purely intraperitoneal hemorrhage have varied from 15,000 to 30,000. In one case of ruptured bowel a sudden rise from 19,400 to 43,400 in three hours, indicated a fulminating pathology, which was revealed at operation.

This brief analysis of symptoms only further illustrates the variability of symptoms and signs of intraperitoneal injury. In not a few cases with all available evidences,—histories, symptoms, laboratory analysis, etc.,—an absolutely differential diagnosis between the severe and non-severe injury cannot be made, and it remains for exploratory operation to reveal the true nature and extent of the injury.

TREATMENT

This brings us to the point of treatment. There is but one safe treatment, and that is early exploratory operation. Procrastination for the purpose of careful observation is permissible only for a period of a few hours. Early operation means a lower mortality rate. Delayed operation means a higher mortality rate. Indefinite procrastination means a very high mortality. The figures which have been given by Siegel showing an increase in mortality rate from 15 per cent to 70 per cent corresponding with periods of time from the first four hours up to over twelve hours, fully illustrate this point and need no further comment. The procedure at the operation is largely a matter of choice

of the surgeon in each individual case. One question which seems to be a mooted point of discussion is whether or not flushing of the peritoneal cavity should be done in cases in which there is a soiling of the peritoneum from perforation. It has been our custom not to use the saline flushing, but to rely entirely upon sponging out the offending material with as little trauma as possible.

CASE-REPORTS

Case 1—29786—R. R., aged 6, male. Run over by automobile on 10-1-19. Location of injury across abdomen and lumbar region back. Discoloration of back. No evidence externally on abdomen. Extensive shock. Pulse very rapid, 160. Cyanosis. No vomiting. Operation not done. Died 6 hours following injury. No autopsy.

Case 2—28977—J. R., aged 31, male. Cave-in of ground, mine accident, 5-12-19. Injury to abdomen and pelvis. Hematoma over and above left ilium and right hip. Complicated by fracture ilium and symphysis. Internal abdominal injury. Extensive shock. T. 98°, P. too rapid to count accurately, 160 plus. Resp., 48. Cyanosis. No vomiting. No operation. Died 6 hours following injury.

Case 3—28177—J. F. L., aged 38, male. Cave-in of ground on 12-11-18. Mine accident. Internal abdominal injury complicated with crushing injury to pelvis. No operation. Extensive shock. Unconscious. Unable to detect any radial pulse. Died two hours following accident.

Case 4—29295—N. McL., aged 11, male. Run over by automobile on 7-10-19. Internal abdominal injury and back injury. Discoloration of back only. At 1:30 P. M. two hours after injury, P. 116, R. 24, T. 97/8° R. At 4:00 P. M., P. 136, R. 30, T 99°. Pronounced shock. Abdominal pain Vomited blood. Laparotomy five hours following injury. Abdominal cavity filled with blood and stomach contents. Rupture of anterior wall of stomach three inches long. Sutured. Closed with drainage. Died three hours after operation.

Case 5—28657—G. F., aged 42, male. Struck by pinch-bar at mine, 8-3-19. Abdominal injury at level of umbilicus, three inches to right. Omentum and small bowel

protruding. T. 98/6°, R. 22, P. 70. Operated on two hours following injury. No rupture of bowel. Some blood in cavity. Closure without drain. Recovered.

Case 6—33359—E W., aged 6, female. Injured in fall (16 feet) 5-19-21, landing on left side and abdomen. No external evidence. Vomited. Severe abdominal pain. Rigidity. T. 98°, R. 24, P. 120. Peristalsis present. W. B. C. 29,000. Neutrophiles, 94 per cent. Many R. B. C. in urine second day. Operation not done. Discharged 5-23-21, four days following injury.

Case 7—31177—C. DeP., aged 45, male. Cave-in of ground, 5-6-20. Injury across abdomen at level of umbilicus and above, as manifested by extensive area of discoloration on third day. Abdominal rigidity. Severe pain. No vomiting. No peristalsis. Admitted 4:30 P. M. W. B. C. 19,400. At 6:00 P. M., T. 99°, R. 28, P 82. At 7:30 P M., W. B. C. 43,400. Operated five hours following injury. Bloody fluid and bowel contents in general cavity. Two ruptures of jejunum, each three-quarters inch long. Developed general peritonitis. Died 5-12-20.

Case 8—31141—F. H., aged 34, male. Struck by tamping stick on 5-7-20., at 4:00 P. M., while blasting. Stick driven into epigastrium at costal angle, point protruding from left lower quadrant. At time of admittance stick was in situ; intense pain, rigidity, cyanosis. Laparotomy one hour following injury, stick removed; blood and fecal material in general cavity. Rupture of stomach, both anterior and posterior walls. Rents one and one-half inches long. Single perforation of transverse colon one and one-quarter inches long. Visceral lesions sutured. Closure with drain. Injury complicated by wound of right arm, avulsion at lower two-thirds of forearm from blast. At 7:00 P. M., T. 101°, R. 50, P. 112. Died at 8:15, approximately four hours following injury.

Case 9—31317—M. S., aged 27, male. Struck by moving car at mine, on 5-18-20, 11:30 A. M. Injury to abdomen and chest. External evidence over 5th and 6th ribs, left chest also one and one-half inches above anterior superior spine, left side of abdomen. Upon admission T. 96/2°, R. 32, P. 58. Abdominal rigidity, pain and vomiting. Percussion showed presence of fluid in abdomen. Bowels moved normally. Peristalsis present W. B. C. 19,000 with 71 per cent neutrophiles. Same evening W. B. C. 31,200, with 90 per cent neutrophiles. On 5-19-20, T. 100°, R. 22, P. 100. W. B. C. 24,700 with

91 per cent neutrophiles. On 5-20-20, T. 98/6°, R. 20, P. 100. Persistent vomiting for two days, greenish in color second day. Laparotomy on 5-20-20, forty-eight hours following injury. Evacuated quantity of blood. No rupture found. Closure without drain. Recovered. Discharged 6-7-20.

Case 10—33504—F. C., aged 28, male. Blow from fist on 6-1-21, 4:30 P. M. No external evidence of injury. Severe epigastric pain radiating to left shoulder. Abdomen board-like rigidity. Nauseated but no vomiting. Cyanotic. Feet drawn up. Peristalsis heard. T. 99/8°, R. 28, P. 94, upon admission W. B C. 6,000 with 64 per cent neutrophiles, at 5:00 P. M. At 7:00 P. M. W. B. C. 17,000 with 87 per cent neutrophiles. Laparotomy at 8:40 P. M, four hours following admission. Evacuated large amount of blood. Some clot under left lobe liver, also splenic region. No rupture found. No other lesion found. Closure without drain. Recovered. Discharged 6-20-21.

Case 11—33968—K. P., aged 13, male. Struck by automobile while riding on bicycle, 9-9-21, 10:00 P. M. Slight abrasion left costal margin. No evidence of external abdominal injury. Extensive shock. T. 100, R. (?), P. 100. No vomiting. Cyanotic. Abdomen very rigid. Severe abdominal pain. General tenderness. Peristalsis present. W. B. C. 15,300, 84 per cent neutrophiles. Two hours later W. B C. 16,800 88 per cent polyneuclears. Laparotomy on 9-10-21. 2 A. M. four hours following admission. Large quantity of blood evacuated. Some clotting. No evidence of ruptured bowel. Lesion not found. Closure without drain. Recovered. Discharged 9-23-21.

Case 12—30860—F. Q., aged 50, male. Fell against a pick in mine on 2-5-20. Injury to abdomen three inches below umbilicus, midline. Small bowel protruding through transverse opening. Bowel good color. Some bleeding from wound. Pain. No vomiting. Rigidity. T. 98/4°, R 28, P. 68. Pulse good quality. Laparotomy two hours following admission. No rupture of bowel. Two lacerations of mesentery, lower portions near ileocecal junction. Lacerations about two inches long, parallel with vessels. Rupture. Closure with drain. Recovered. Discharged 3-18-21. No symptoms since then.

Case 13—31818—L. S. aged 8, female. Kicked by horse on 8-23-20, left side of abdomen just above umbilicus. Admitted to hopsital 8-25-20, over forty-eight hours following injury, with typical general peritonitis. Laparotomy. General cavity filled with fecal material and blood. Rupture of jejunum which would admit finger.

Closure with drain. Died immediately following operation.

Case 14—33799—J. O. aged 48, male. Struck against horn of saddle on 6-17-21. Injury to abdomen, lower left quadrant. Admitted on 6-9-21 with general peritonitis apparent. Had a left inguinal hernia. Herniotomy showed pus in sac, also marked necrosis of incarcerated omentum. Left rectus incision. General cavity contained considerable pus, bile stained, and some food particles. Marked fat necrosis of omentum. Rupture of bowel not found. Most probably high in jejunum. Drainage. Recovered. Discharged 7-30-21.

Case 15—31078—F. V., aged 21, male. Slipped in the mud and fell against post, striking against "pit of stomach" on 4-20-20. Bruised over lower chest and upper abdomen. Severe pain one-half hour later. Vomited slight amount of blood. Abdomen rigid. T. 98/6° R. 20, P. 66, W. B. C. 18,200. No operation. Recovered 4-23-20.

Case 16—31523—J. P., aged 35, male. Injured by compressed air into rectum, on 10-23-21, 5:00 P. M. Shock, extensive pain in abdomen, tenderness and rigidity mostly on right side of abdomen. Cyanotic. No peristalsis heard; tympany on percussion. No marked distention. Bowels moved and passed flatus. On admission T. 98/6°, R. 24, P. 70, W. B. C. 12,600. 77 per cent neutrophiles. At 8:00 P. M., W. B. C. 18,000. 95 per cent neutrophiles. P. 76. At 9:00 P. M., P. 100. Laparotomy at 12:20 A. M. Some blood, fresh in general cavity. No gas. Rupture of serosa of sigmoid three inches long. Rupture of serosa of cecum. Marked ecchymosis in transverse colon (near hepatic flexure) and in lower part of cecum. Appendicostomy done. Closure with drain. Recovered. Discharged 11-22-21

Case 17—32940—A. C. F., aged 26, male. Acute strain of and possible blow upon lower abdomen, right side, just below McBurney point, by a mine timber car. Injury on 2-22-21, at 4:00 P. M. Admitted to hospital morning of the next day. Pain in right lower quadrant of abdomen. Ecchymosis of skin just below McBurney point and a round, soft tympanitic swelling just underneath, while standing, that disappears on lying down. No gastrointestinal symptoms. Operated 2-24-21. Aponeurosis of external and internal obliques and transversalis split in the direction of thin fibers; edge of right rectus exposed and a few fibers torn; peritoneum ruptured about size of dollar. No visible blood in the peritoneal cavity. Anatomic closure. Recovery.

TABLE I.

No.	Nature of accident	Result of accident	Operated	Time after injury	Outcome	Chief Symptoms
1.	Run over by automobile.	Dislocation lumbar region; internal abdominal injuries.	No	.....	Died in 6 hours	Shock, Cyanosis, Rigid abdomen.
2.	Mine cave-in.	Hematoma over left ilium and right hip fracture ilium. Internal abdominal injuries.	No	.....	Died in 6 hours	Shock. Cyanosis. Rigid abdomen.
3.	Mine cave-in.	Fracture pelvis. Internal abdominal injury.	No	.....	Died in 2 hours	Shock. Unconscious.
4.	Run overy by automobile.	Dislocation of back Internal abdominal injuries. Ruptured anterior wall stomach.	Yes	2 hrs.	Died in 5 hours	Shock. Abdominal pain. Rigidity. Vomited blood.
5.	Struck by pinch bar at mine.	Rupture abdominal wall. Omentum and small bowel protruding.	Yes	2 hrs.	Well	Local pain. No shock.
6.	Fall of sixteen feet.	Internal abdominal injury.	No	.....	Well	Severe pain. Rigidity. Vomiting.
7.	Mine cave-in.	Internal abdominal injury. Two ruptures of jejunum.	Yes	5 hrs.	Died in 6 Days	Rigidity. Severe pain. No vomiting. No peristalsis. Developed general peritonitis.
8.	Blast. Struck by tamping stick.	Stick driven in epigastrium and protruding left groin. Perforated stomach, large and small bowel. Liver torn. Arm blown off.	Yes	1 hr.	Died in 4 hours	Intense pain. Rigidity. Cyanosis. No vomiting.
9.	Struck by mine car.	Bruises over 5th and 6th ribs, left breast and one-half inch above anterior superior spine ilium. Blood in peritoneal cavity.	Yes	48 hrs.	Well	Abdominal rigidity. Pain. Vomiting. Pulse slow. Bowels moved after injury.
10.	Blow from fist.	No external evidence of injury. Blood in peritoneum.	Yes	4 hrs.	Well	Board-like rigidity. Nausea, but no vomiting, Cyanotic. Feet drawn up. Peristalsis.
11.	Struck by automobile.	Slight abrasion left costal margin. Blood in peritoneum.	Yes	4 hrs	Well	Shock. Cyanotic. Rigid abdomen. Severe pain. No vomiting. Peristalsis present.
12.	Fall upon pick in mine.	Puncture of abdomen 3 inches below umbilicus midline. Bowel protruding. Lacerated mesentery.	Yes	2 hrs.	Well	Rigidity. Pain but no vomiting. Pulse normal.

TABLE I.—CONTINUED

No.	Nature of accident	Result of Accident	Operated	Time after injury	Outcome	Chief Symptoms
13.	Kick of horse. Female, 8 years.	Admitted 48 hours afterward. Classic general peritonitis. Fecal matter in peritoneum. Jejunal rupture.	Yes	On admission.	Died shortly after operation.	Symptoms classic.
14.	Thrown against horn of saddle. Male, 48 years.	Admitted 48 hours afterward. Symptoms of general peritonitis. Left inguinal hernia tense. Pus and fat necrosis peritoneal. Bruise left lower quadrant.	Yes	On admission.	Well	Syptoms classic.
15.	Fall against post. Male, 21 years.	Bruised lower chest and upper abdomen.	No	.....	Well	Pain one half hr. afterward. Vomited some blood. Rigid abdomen.
16.	Compressed air into rectum. Male, 35 years.	Some abdominal distention. Rupture of serosa of cecum and sigmoid. Blood in peritoneum.	Yes	5 hrs.	Well	Shock. Cyanosis. Rigid right side of abdomen. Pain. No peristalsis. Bowels moved, passing fecal matter and gas.
17.	Acute strain and possible blow on abdomen from mine car.	Ecchymosis of skin in lower right quadrant. Tympanitic swelling underneath. Rupture of abdominal wall at location.	Yes	42 hrs.	Well	Hernia on standing, disappearing on lying down. Tympanitic. Some pain. No rigidity. Walked into hospital next evening following injury.

TABLE II.

The etiology of these abdominal injuries, as we have encountered them is as follows:

Fall of ground (cave-in)	3
Run over by automobile	2
Run into by automobile	1
Struck by pinch-bar	1
Struck by fist	1
Struck by moving car	1
Struck by tamping stick	1
Fall to ground	1
Fall against pick	1
Fall against post	1
Striking against saddle	1
Kick by horse	1
Pneumatic injury	1
Strain with possible blow	1
Total cases	17

In four of these injuries the patient was the moving body, falling against a fixed object, while in thirteen cases the patient was standing with moving objects directed toward him. In five of these cases the injury was of a crushing nature, while in eight it was of the character of a sharp, sudden blow with a smaller area of injury.

TABLE III.

	Run over.	Horse kick.	Kick, human.	Falling.	Struck by tongue or wagon.	Caught between objects.	Piece of wood from circular saw.	Falling against fixed object.	Crushed.	Blows.	Knocked down.	Miscellaneous.	Total.
Von Winckel	2	2		3	4	2						1	14
Lund, Nicholls and Bottomley	1	3		1							1		6
Homer Gage		3	2	19			6						85
Makins	5	6				3		4				3	21
Berry and Guiseppi	51	16		11					24	23			132
Stone, Harvey B.		1		2		1							4
Moynihan	13	5		5		6				2	6	7	44

TABLE IV.

Location of Injury

	Stomach.	"Small bowel."	Duodenum.	Jejunum.	Ileum.	Large intestine.	Large and small intestine.	Total.
Homer Gage			10	20	43	6		77
Berry and Guiseppi		25	23	35	32	10	4	132
Lund		18				1		19
Von Winckel	1	10	2			1		14
Chavasse		106	7			19	8	140
Curtis		109				4		113
Stone				1	3			4

FOR DISCUSSION SEE PAGE 180

THE NON-TRAUMATIC "ACUTE ABDOMEN"

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"It is unnecessary to indulge in any discussion" of scientific terminology as to the origin, the meaning, or the significance of the phrase—"the acute abdomen." We interpret it as the acute expression, or manifestation, of a chronic pathological condition within the abdomen, which requires the immediate consideration of the physician and the intervention of the surgeon, and usually prompt operation. It results from a variety of diseased conditions with which surgeons are familiar. The large percentage of abdominal operations in general surgery justify further consideration of the acute abdomen.

The most common causes are acute infections of the appendix and gall-bladder, perforation of duodenal, gastric, peptic and typhoid ulcers, and intestinal obstruction before or after operation; while acute dilatation of the stomach may be noted, with the suggestion that no operation other than the use of the stomach tube is justifiable in its treatment. Acute hemorrhagic pancreatitis is to be differentiated from ileus which it resembles in symptomatology. Other diseased states of the abdomen are important in this connection, but I can only hope on this occasion to consider the more frequent conditions met with.

In any view of the subject, diagnosis is essential and of the first importance. We learn from experience that the art of diagnosis is not the product of the laboratory, but of the sick room.

Anamnesis seems a lost art as the instruments for a more scientific and accurate solution of the problems which confront and embarrass us have been developed, and occupy such a deservedly conspicuous place in the study and evolution of disease.

When we, to so great a degree, subordinate our best thoughts and judgment to the refinements of the laboratory, or to any specialism that is narrow and exclusive, we circumscribe our own vision and embarrass our intention to render the best possible service to the patient. The habit of a short-cut to the laboratory is often a neglect of duty, of opportunity and responsibility to the patient—not that I underestimate the value of any equipment that is so necessary to the perfection of our work, but I also realize the dangers in any system which confines one to a rut so narrow as to defeat the best efforts in the practice of medicine and surgery.

These acute conditions are common, and in many of the cases with which the surgeon has to deal the history is not satisfactory. Quick decision and intervention are necessary to the patient's welfare. The physician or surgeon who is in the habit of investigating histories and analyzing the signs and symptoms which differentiate disease, and who makes a careful examination of the present condition of the patient, will more certainly adjust his conclusion to the facts and his procedure to the best interest of the patient, than the one who rushes to the laboratory and Röntgen-ray establishments and expects these accomplished students in scientific specialism, not only to make the diagnosis, but also to direct the treatment.

To travel this road is to be ever at sea in indecision and guess-work, and while it may find its recompense in the credulity of the patient, yet in the final synthesis surgical principles and judgment, not policies, will determine the fate of surgery as well as of surgeons.

I am in entire agreement with those who consider the laboratory of little or no value in the diagnosis and treatment of these acute abdominal conditions.

The differential diagnosis is of such importance as to demand immediate consideration of all obtainable facts in the clinical history.

Death is due to septic peritonitis, the prevention and treatment of which depend on prompt operation.

We appreciate that bile secretions and those of the stomach and duodenum contain no pathogenic bacteria in health, but the pathologic condition resulting in gangrene and perforation leads rapidly to local and diffuse septic peritonitis.

There are two conditions in abdominal surgery which admit of no operative delay, even in the presence of shock; these are hemorrhage and perforation. In such urgent conditions, local anesthesia is to be preferred. The visceral peritoneum has no pain sense; the parietal has, but controllable by nerve blocking and the application of local anesthetics. The condition and environment of each patient will, as a rule, determine the operative procedure and the form and extent of anesthesia. The symptoms of perforation are pain, fast pulse, some degree of shock, muscle rigidity, abdominal distention, and vomiting. With marked and persistent distention, muscular rigidity disappears and consequently ceases to be of value in the diagnosis. It is just such cases, when seen for the first time, which give added interest and value to the clinical history.

In only very exceptional cases should there be any doubt as to the importance and desirability of excising the focus of infection (in any operative procedure.) Drainage is necessary and if the primary source of infection is not removed, convalescence is delayed, drainage prolonged, and recovery rendered more doubtful.

Some surgeons still use the gauze pack for a short time in severe localized infections, and under such conditions porous material that will not adhere to the tissues should underlie the gauze. This form of drainage is only justifiable in bad cases due to the too long delay of an urgent operation. The gauze should be removed in twenty-four or thirty-six hours, and usually should not be reapplied. After saturation gauze does not drain and it then becomes a source of infection. In mild cases of localized infection with sero pus, a wick drain for twenty-four to thirty-six hours is adequate and often renders reopening of the wound unnecessary, but in severer infections, the rubber tube or glass drain answers the purpose better. It should be insisted that the tube should be changed often and discarded as soon as possible, for it becomes a source of infection when retained too long.

Surgeons may differ as to the best time for operation in certain acute and delayed cases. Obscessed with the idea that starvation and the salt water rectal drip will hold in abeyance the progress of the infection, they counsel delay, in the hope that a more auspicious hour will arrive when operation will promise a better result. That hour frequently does not arrive. This procedure was, if it is not still, a popular fad with some physicians and surgeons, which to my mind admits of no satisfactory defense. In my opinion the delay increases the mortality. In general septic peritonitis, death is inevitable without operation; to delay it insures additional complications, and makes operation more difficult and recovery more doubtful.

The method of choice is to operate at the earliest opportunity in one or more dependent positions; if necessary irrigate with warm salt solution or any mild antiseptic, and drain. Adhesions and encapsulation prevent irrigation and drainage of the peritoneal cavity, usually for more than thirty-six hours. Many reported recoveries in diffuse peritonitis are in reality only localized or are encapsulated abscesses.

A gangrenous gall-bladder and usually those of long-standing infection should be removed. If the walls are elastic, and show no positive pathological evidence of involvement, drainage will be efficient and often satisfactory. If there are stones in the ducts it may be more desirable to do a cholecystotomy and drain. Many small stones are not infrequently overlooked and should cystectomy be performed, the changed topography and adhesions increase the difficulties of a necessary secondary operation. I have always found the liver enlarged in chronic infections of the biliary tracts and in cholelithiasis. Cholecystectomy does not of itself correct the constitutional vice common to cholelithiasis.

Bile, like the chyle and gastric juices, is normally discharged only, or chiefly, during digestion. If the normal gall-bladder has a useful purpose as a reservoir for the bile as we believe and perhaps also as a secretion organ, then is it not a wise physiological provision for the ducts which dilate to supply these needs after cholecystectomy. Are we not justtified in suggesting, or urging, more circumspection and discrimination in the operation of cholecystectomy, which has become a national habit, if not an abuse, of a necessary operation? While drainage has an immediately good effect on the cholemia and condition of the liver, it has also a salutary influence on the pancreatic condition—this organ being so commonly diseased secondarily to infections of gall-bladder and ducts.

In the *Annals of Surgery* for September, Muller and Ravidin report fifteen cases of perforation of gastric and duodenal ulcers with favorable results from *prompt* operation, and *note,* as interesting, that four of the cases elicited no history of ulceration previous to the perforation, especially in the absence of pain. These are designated atypical cases—there being a sensible diminution, instead of increase, of the hydrochloric acid.

There is some division of sentiment as to hyperacidity being the cause of pain, but it seems to be admitted that the hydrochloric acid is an irritant to the exposed sensitive endings of the vagus and vasomotor nerves of the ulcer and that this causes increased motor activity of the ulcerated area. This fact, it seems to me, would fully explain Hurst's theory of tension as the sole cause of pain in these ulcers, nevertheless the acid would still remain the ultimate and chief cause of pain. My credulity is not easily reconciled to the statement that long standing ulcers progress to perforation without any previous evidence of disease. It reminds one of the many cases of acute appendicitis in which the patient professes no knowledge of any previous illness, and yet careful investigation reveals evidence which was unappreciated by the patient, yet conclusive to the surgeon who makes a careful investigation of the case.

In a recent paper by Judd, published in "Surgery, Gynecology and Obstetrics" in October, he states that in the experience of the Mayo Clinic no case of primary jejunal ulcer has ever been noted and all were secondary to gastro-enterostomy and generally due to the use of nonabsorbable sutures. He finds but one mention of a primary case and Frankel and Katz reported a second. No gastro-enterostomy had been performed in these two cases and the authors believed the ulceration in these cases due to constitutional syphilis.

I desire to report one case of jejunal ulcer I believe to have been primary, and in which there was no history of duodenal or stomach ulcer and no gastro-enterostomy had been performed.

H. M. F., aged 37 years; sent to me September 28, 1913, with typical history of acute appendicitis of five days' duration. His condition seemed almost hopeless; pulse, almost imperceptible; skin cold and moist; abdomen, greatly distended. Two stab wounds—one over region of appendix and the other supra-pubic were made

at once. Pus flowed in a forcible stream from both openings. Drainage tubes were inserted and the peritoneal cavity irrigated with warm salt solution. This was continued on the second day. Briefly stated, the patient, after a stormy period of two weeks, was discharged well in six weeks from date of operation, with both wounds healed. He resumed his vocation as telegraph operator. Eleven months from this date, August 14, 1914, he walked into my office with the statement that for a week or two there had been a discharge from the supra-pubic opening. On examination with a long flexible probe I traced the fecal fistula to the external border of the left rectus and one inch above the umbilical line. An immediate operation demonstrated a loop of the jejunium broadly adherent to the parietal peritoneum. The intestine was released and sutured, and patient discharged from St. Luke's Hospital well in two weeks. For the first time, I now obtained definite and satisfactory evidence that the patient, some years previously, suffered from constitutional syphilis. In 1919, after my discharge from the army, he again called on me perfectly well as to abdominal conditions, but had characteristic symptoms of early brain syphilis. He was then in the care of neurologists and I learned that blood and spinal fluid tests were positive as to syphilis. He is now in the Kansas Asylum for paresis. The case is interesting as to the existence of primary jejunal ulcer and its possible relation to syphilis as a cause.

The subject should not be dismissed without brief consideration of intestinal obstruction, dynamic and adynamic, the former due chiefly to adhesions, volvulus, and the pressure of tumors, usually carcinomas of the large bowel. Ordinary mechanical obstruction is attended with pain and vigorous peristalsis above the seat of obstruction, increased pulse rate, but no elevation of temperature, and with vomiting, which becomes fecal. The history of these cases is absolutely necessary to an intelligent opinion. Immediate operation gives relief. If operation is delayed, complications will soon ensue, and enterostomy or resection and anastomosis may be necessary as a final life-saving measure.

In septic ileus there is intestinal paralysis; increased, though at times subnormal temperature; fast pulse;

vomiting, not fecal; and muscular rigidity. Persistent distention in this condition should be regarded as an unfavorable omen. Ileus, before operation, suggests operative delay that may or may not have been avoidable. In these aggravated cases it would, in my opinion, be a wise precautionary measure to include enterostomy in the primary operation. It is perhaps unnecessary to state that in some cases the condition seems so hopeless that it would be usless to undertake a serious operation; yet one occasionally records a recovery from a desperate situation by operation. There are also conditions, especially of the heart, lungs and kidneys, in which operation is contra-indicated.

When in grave doubt as to the condition and the procedure to adopt in a given case, we feel compelled to explore the abdomen, which may be of great service in some cases and of no value in others. With increasing knowledge and a greater degree of perfection in diagnostic acumen, the exploratory operation will not frequently be deemed a necessity.

I have refrained from any attempted exposition of technic or operative details, feeling assured that every good surgeon's duty and inclination is to meet the indications in individual cases in accordance with his own judgment and the recognized principles of modern surgery.

DISCUSSION OF THE TWO PRECEDING PAPERS

Dr. William T. Reynolds, (Kansas City, Mo.): I would like to say a few words in regard to Dr. Witherspoon's paper. It is an amazing, but well-established fact that the slightest blow will produce rupture of a hollow viscus inside the peritoneal cavity. When they were building the Armour, Swift, Burlington Bridge across the Missouri River at Kansas City a man fell off a trestle into the water. He was recovered in probably fifteen or twenty minutes and was found to be dead. The contractors, who were building the bridge, asked me in conjunction with the coroner to make a record of the post-mortem findings. The man was a big muscular fellow and there was not the slightest indication of an injury on him, externally.

He had no ecchymosis anywhere. We opened his peritoneal cavity and found it full of blood, bile, and stomach contents. He had a rupture of the stomach, a rupture of the transverse colon, and a complete rupture of the liver.

A man living on a farm outside of Kansas City went up into the hay loft to pitch hay down into the mangers for his cows. He slipped and fell, striking himself in the left flank. He could not have fallen more than four or five feet. He finished putting hay in the mangers, and when he came down out of the barn was greatly nauseated. He went outside of the barn and started for the house. Before reaching the house he felt a desire to void. After reaching the house he was very much nauseated and lay down on the bed. Soon after he desired to void again, did so, and found he was passing blood. The following morning he felt much better; the blood had cleared up. and the following day he was out and around. Ten days later he was taken suddenly ill, had a hard chill and extreme nausea. On examination it was found he had a boggy mass in his left kidney fossa. We cut down on it, found the left kidney fossa filled with blood, and a completement detachment of the upper pole of the kidney.

Dr. Porter: Was the kidney normal when he was hurt?

Dr. Reynolds: "I think so."

Dr. Donald Macrae, (Council Bluffs, Iowa): I would like to report two cases. We have all seen these cases of compressed-air injuries. I am surprised that Dr. Reynold's patient got well. Both of my patients had extreme shock. In both the intestine was ruptured in two or three places, —one in two places, and the other in three, the entire large intestine being gangrenous.

Personally, I do not like the terms acute "traumatic belly" and "acute abdomen." I do not know exactly what is meant by those terms. Some are talking about gallbladders, others are talking about appendicitis, and still others of "acute bellies." In the acute abdomen we do not know what is going on, and the term "acute abdomen" is a term tending to lessen our careful study and observation of individual cases. Experience hinges on bedside observation, as has been said, plus perhaps the immediate aid from the laboratory. However, I do not think we should be guided solely by the laboratory findings in moulding our opinion. When we see a man, or woman, with an "acute belly," we should not jump to the

conclusion that we have a case of cholecystitis or of gallstones.

If something serious has gone wrong in the abdomen, by a careful study of the case for thirty minutes or an hour, going into the minute details of history, age, occupation, etc., we may surprise the physician, and in the end develop a tentative diagnosis pretty close to the truth. Study of "a case" is most important to a thorough understanding of all cases.

Dr. Peter A. Bendixen, (Davenport, Iowa): The subject of traumatism to the abdomen is an important one, and especially to those who are doing industrial surgery. The question as to when, and when not, to operate in a given case is also very important. Personally I am of the belief that when in doubt, and the patient is in a fairly good condition, we should operate and ascertain what pathology is on the inside of the abdomen. The case that I wish to relate was one of pneumatic rupture of the bowel.

In January, 1914, I reported a case of pneumatic rupture of the bowel in Surgery, Gynecology and Obsetrics. Dr. Wyllys Andrews, of Chicago, in January, 1911, in the same magazine, reported a series of 14 cases, and with the cases that we collected, made a total of 21 cases. Of this number 17 died, and 5 recovered. The patient that came under our observation made an uneventful recovery, and I believe that the only thing that saved the man's life was due to the fact that he submitted to an operation within one and one-half hours after the accident.

With reference to the mechanism of a pneumatic rupture of the bowel: I want briefly to call your attention to the anatomical arrangement of the perineum.

This anatomical condition is a peculiar formation of the pelvic floor, forming a funnel, whose apex is at the anus; the confined air expanding in this funnel will force the gut open without having the end of the pipe accurately adjusted to the anus. With the involuntary contraction of the levatorani and sphincter muscles, the space between the buttock would be narrowed and the funnel deepened, thus confining the escaping air laterally, and leading it more quickly into the bowel.

In all of the cases mentioned, air was applied, not directly to the rectum, but about six or eight inches away from the rectum. After the air has once entered the rectum you will readily see that its course is up the descending

colon, over the transverse colon and down the ascending colon. You will also note in the cases that there is very little or no injury about the rectum. In our case we found three lacerations ranging from two to four inches in length on the descending colon; one large laceration about six inches long was found on the transverse colon near the hepatic flexure; in the center of this laceration we found a small perforation of the bowel. Four lacerations ranging from one to four inches were found on the ascending colon; two lacerations about two inches in length were found on the ileum about eight inches away from the cecum. A laceration of about three inches was found in the mesentery near the junction of the ileum with the cecum.

In all of these cases you will find a bulging of the mucous membrane through the intestinal muscle and peritoneum, but you will find only one perforation of the bowel. Just as soon as this perforation occurs the air escapes into the free peritoneal cavity.

I desire to report this case as an addition to the one cited by the Doctor.

Dr. James F. Percy, (San Diego, Calif.) : I want to speak of one phase of this subject, namely, the material used for drainage. Neither Dr. Witherspoon nor Dr. Grant mentioned the value of the rubber dam in abdominal drainage. I cannot understand why surgeons will use gauze in the abdomen when they can get the incomparable rubber dam. It never sticks, it never fails to drain, and I have never known it to cause fistula, something that cannot be said of gauze. Not the least of its valuable uses is the one of its holding the abdominal contents away from the abdominal incision, so that one rarely sees a loop of protruding gut, and the healing in the abdominal incision is not interfered with, so that a subsequent hernia is exceedingly rare, even when the incision is an extensive one. This permits of the freest use of this material. I have put yards of it in one strip in a single belly where the infection was disseminated and have the patient make a good recovery, where I am quite sure the patient would have died had I used any type of gauze drain.

At a subsequent meeting of this Association I hope to report my extensively infected abdomens that have recovered under the use of this material when used as a drain. You can tuck rubber dam in anywhere in the abdomen, and it does no harm, causes no shock, and it

always comes out easily, and I must repeat—it always drains.

There is one important warning in reference to its use, and that is to be sure to wash off the starch that is on it before it is put into the abdomen; and also do not put it in cold. Dr. Pope, in the experimental laboratory of the University of California, has shown that the powdered starch, especially on our rubber gloves is a prolific source of subsequent intestinal adhesions. This is the explanation in many instances of the extensive adhesions so often found following a simple appendectomy, which we encounter with surprise when the abdomen is opened at a succeeding operation. Pope has shown the starch granules, under the microscope, embedded in these adhesive structures.

Dr. Frederick G. Dyas, (Chicago, Ill.): There is a growing tendency on the part of a great many operators to close up the abdomen tightly in the presence of pus. It is hard to understand why that tendency should have ever taken root at all, but it is growing, and within the last two or three years I have had to open up the abdomen again after it had been closed in the presence of free pus. The operators not only take this ground themselves, but they teach students that it is good practice to close up the abdomen tightly in view of the well-known property of the peritoneum to take care of pus. I think everything possible should be done to discourage that practice.

I have seen thrombosis of the portal vein in one case following such a procedure, not by inexperienced men at all. This particular surgeon who did the original operation was a man of broad experience, a professor in one of the universities, and he not only does it, but he recommends it and emphasizes it to his students. I think the profession as a whole ought to take notice of this and condemn it unsparingly. There is no other place in the whole body where a surgeon would want to close the operative wound in the presence of a quantity of pus. Where the abdomen is closed in the presence of pus we have all the conditions for the growth, for the development of pathogenic organisms, namely, serum and body heat, and peritonitis results in many cases

Just one other point. In operating in the presence of intestinal obstruction caused by mesenteric thrombosis the diagnosis is rarely made beforehand. Since I have had my case which resulted successfully following resec-

tion, I have seen two others published in the literature. I take the opportunity of recommending to you, instead of closing the abdomen, as I was taught to do in college, in the presence of thrombosis of the mesenteric vein, with gangrene, to resect the bowel in the hope that the patient may live. He will not live if the abdomen is closed up. There are cases of successful resection of the bowel for mesenteric thrombosis.

Dr. Witherspoon (closing on his part): First, let me say that I agree with Dr. Macrae thoroughly in regard to the acute traumatic belly when he says we do not know what has occurred inside of the belly from the trauma. However, I cannot agree that it is a good plan to operate on all of these cases immediately. I am quite sure operation is uncalled for time and again. Many patients suffering extreme symptoms may not need an operation, and in those who do the serious shock will increase the risk taken by the patient. It is possible that in most instances a fairly correct solution of the damage by trauma can be arrived at before operation is undertaken.

As for drainage material: We constantly use gauze surrounding by gutta-percha tissue. We find this drain by trauma can be arrived at before operation is under-be used for only a few days while it is serving a distinctly helpful purpose. When drain is used at all we count on infection, and the case is treated accordingly. Our chief reliance in drainage is upon a perforated aluminum drainage tube. The perforations in the tube should be no larger than the point of a pencil, otherwise granulations grow into it and make removal difficult. When the acute purulent discharge subsides the aluminum tube is removed, and a rubber tube used in its place. The rubber tube is slipped through the aluminum tube to the bottom of the wound, and the aluminum tube is drawn out over the rubber tube, leaving it in situ. If the aluminum tube is removed first it is sometimes difficult to introduce the rubber tube to the bottom of the wound.

We feel that in every case there is an individuality, and it must offer in part its own solution. There is no definite ruling we have been able to follow in all cases. We must take into consideration location of the blow or injury, the character of the pain, abdominal muscle spasm, vomiting, shock, tympany, transmission of the heart and respiratory sounds to the belly, etc. It is the composite picture that guides. We have found that relying upon any one symptom is futile, often misdirecting.

Dr. Grant (closing): If the last speaker had listened attentively to what I said, he would have known that I did not say I used gauze much as drainage material, as there are serious objections to its use generally. In the conditions which I stated, I used perforated gutta-percha tissue next to the living tissue and gauze packed over it. Some excellent surgeons have recently made reports about its use in such cases as have been related here. In perforated appendices, with a considerable area of extravasation, if used for twenty-four to thirty-six hours, it does great good. It does not drain after saturation, and then it is a source of infection. It cannot do any good kept in for four or five days.

The statement of another speaker that we do not know anything about what is "inside the acute abdomen," is a severe indictment of the diagnostic acumen of the profession. I believe many surgeons do know what the pathological condition is and also the focus of infection. If we do not know that, as a rule, we are justified in saying that there are a great many good operators, some good surgeons, and few good diagnosticians.

I had the purpose of stimulating more careful investigation of cases that will enable us to determine in advance or before we operate what, as a rule, the condition is, and I believe the tendancy of the surgical profession to-day is to justify and to urge more careful clinical investigation and the meaning of signs and symptoms of disease, because, as long as the laboratory is to make the diagnosis, surgeons will have no opinion as to the conditions within the abdomen. There are cases in which we do not know what has taken place inside the abdomen, and these justify an exploratory operation. Unless these cases are brought to the surgeon early, it is often impossible to get a satisfactory history or to appreciate exactly what the condition is, yet they are operable and require prompt intervention.

INTESTINAL OBSTRUCTION

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Intestinal obstruction remains one of the clouds in the sky of surgical progress. Not that we have failed to give it due consideration as clinicians or laboratory investigators, not that we as surgical specialists or the profession at large, have underestimated its gravity, but the fact remains, and, if we are honest with ourselves, we must admit it, that somewhere down the line there exists in every case which develops intestinal obstruction a possibility of relief, and failure means one of three things: (1) that in the preventable cases we have omitted certain precautionary measures. (2) that in the inevitable cases we have either failed to recognize the trend of things, or (3) in either of the foregoing events we have failed to apply the proper measures at the right moment.

I use the term "we" advisedly. It is both customary and decidedly convenient for those of us who earn our bread from referred work to lay, at least in our own minds, the blame at the door of those who first see these cases, and, having exhausted all palliative means, turn to us at the last to avert the calamity which only too often arrives. I know of no more discouraging or desperate problem in all surgery than to be confronted with a patient with a gas-locked abdomen; pinched, anxious face; thready, rapid pulse; wet skin and cold extremities; vomiting; and in great distress of mind and body, unless so numbed by the toxemia or the inevitable opiates that he is past suffering.

In such instances, beginning so often in apparently healthy individuals with a simple, colicky seizure, we feel in our own minds, even if we do not openly say so, that there has been a *faux pas* somewhere, and complacently comfort ourselves, when the end comes, that the fault was not ours, even when rudely disturbed from our day-dreams by the press notice stating that the "Physicians Were Baffled," headed "Death Follows Operation." But what shall we say of those instances which arise from the very beginning under our own eyes, and proceed to that same fatal termination? That is why I say "we."

In analyzing this situation it is not necessary for me to cover the entire question nor to tire you with exhaustive case-reports. My experience has developed two or three points of attack, and on these I shall center my forces, fully aware at the same time that I may not be able to summon enough heavy artillery to make a decisive showing. Nevertheless, it is only by constant effort on our part that we are able to clear up any situation, and, even if fruitless in result, I shall hope to accomplish something by the agitation of these vulnerable points.

First, then, is the occurrence of obstruction at remote periods following abdominal operations. In my observation this type appears most commonly at about five years subsequent to the original operation. Whether this is a coincidence or not I am unable to state, but I recall having seen at least four such cases within the last ten years. The first of these was in a single woman aged thirty-five, whose appendix had been removed in the interval five years before. The classical syndrome of obstruction developed abruptly, the one misleading symptom being that, while much distended, she was able to expel large volumes of flatus, and this, more than anything else, contributed to mask the diagnosis.

When operation was finally done, a loop of gangrenous ileum about three inches long was found

pinched under a short band of connective tissue attached directly to the head of the cecum at the site of the appendix, evidently a scar remnant of the operation. In this case I did a quick excision of the gangrenous gut, brought up both open ends in double-barrelled shot-gun fashion, and anchored them to the abdominal wall, but without averting the fatal termination; in other words, "she died following the operation."

In a somewhat similar case a middle-aged farmer was brought in with distended abdomen and vomiting semisolid feces. His pulse and appearance completed the basis for a diagnosis of intestinal obstruction with beginning peritonitis. His appendix had been removed several years before. Having a small estate and a large family, the services of a lawyer were procured, and a will was drawn up, after which we proceeded to operate. The terminal ileum was found adherent to the abdominal scar and torsion to the extent of complete occlusion of the bowel had occurred, the entire small intestinal tract being found enormously distended and hemorrhagic patches of the mesentery in numerous places, as well as in the intestinal wall itself. The small intestines contained a large volume of fluid feces. As this was before permanent enterostomy had become popularized, I syphoned off most of the fluid intestinal content through trocar punctures, and closed with linen purse-strings, enabling the return of the viscera to the abdomen. The patient proceeded to recover.

The third case was that of a physician previously operated on twice, first, for the drainage of an appendiceal abscess, and, six weeks later, for a recurrence, at which time the appendix was found and removed. During the next few years succeeding he had occasional twinges of abdominal pain, but nothing severe until a year ago last Thanksgiving Day, when, after the usual dietary excess associated with that holiday, he began to suffer abdominal pain, which

increased during the night and did not abate for hot applications, sedatives, etc.

The following morning I saw him and found him in great distress, abdomen distended and tense, no gas passing, pulse fast and weak, and facial expression anxious. At operation a loop of small intestine was found adherent in the pelvis, twisted, and, on liberation, the lumen of the tube was restored by intra-intestinal pressure. The patient recovered promptly.

The fourth case was that of a young farmer, also operated on about the same length of time before, the operation showing permanent constriction of the small intestine by hand pressure. A rapid lateral anastomosis was done, but death occurred, due possibly in this case to secondary hemorrhage incidental to the use of anastomosis clamps.

My own feeling about cases of the type just described is that the most likely factor in their production is the well recognized tendency of scar tissue to contract. This view is fortified especially by the conditions found in the last example, where band pressure extending over a considerable period of time had resulted, not in gangrene, but in such an increase of thick, unyielding tissue in the intestinal wall as to produce, ultimately, obstructive symptoms. The logical deduction is prompt operative intervention as soon as symptoms suggestive of obstruction appear, even if considerable time has elapsed since the primary operation.

I now turn to the type of case in which obstructive developments follow soon after an abdominal operation. These, in my experience, fall readily into three classes: (1) those due to mechanical causes (adhesion-formation and its consequences), (2) those in which operations for chronic infections and their results have been done, (3) those occurring in individuals of lowered systemic resistance. The first mentioned are not the most common. Obstruction seldom seems to occur when most expected, in the

cases where the peritoneum has been denuded extensively, for instance, or the anatomical relations have been altered by the extensive removal of organs or growths. It does happen more frequently in the second and third classes, especially when combined in the same individual, and this, together with the fact that the obstructive symptoms are not always typical in these cases, leads me to assume that what bears some of the earmarks of obstruction may in reality be low-grade peritonitis.

I cannot help feeling in these latter cases that we have let the drainage pendulum swing a little too far in the direction of conservatism. In our anxiety to secure quick, clean operative recoveries, we have made closures without drainage when it would have been the part of better surgical judgment to have drained, for it is in just this type of case that trouble develops. Last spring I operated on a woman of 43, who had been infected at the birth of her first child, twenty years before. I removed the left tube and ovary, both bound down by old plastic exudate and apparently free from active infection. It was a clean piece of work, and I was inclined to feel satisfied with it. Five days later the patient was acutely ill, distended, vomiting, and unable to pass gas or feces. I re-opened under novocaine, and did an enterostomy on the first presenting loop with only partial success. The next morning another distended loop presented, and I did an enterostomy on that one and also on another one.

In spite of an intercurrent nephritis she weathered the storm until it became time to consider disposing of the enterostomy opening, when she decided to go elsewhere, and died on the morning following a resection. This to me was clearly a case of low-grade peritoneal infection following the first operation, and I use it as an illustration of the type of case in which drainage might have made a difference.

I have kept my word and confined my remarks to these two phases of a very large subject. The main question has been most thoroughly and practically covered by Harold Leslie Barnard, an English surgeon who died about thirteen years ago at the age of 40, and is published in a posthumous volume entitled, "Contributions to Abdominal Surgery," the portion given up to intestinal obstruction covering two hundred and fifty-four pages. It has not been published in this country, and, finding that it is little known, I take this opportunity of bringing it to your attention.

DISCUSSION

Dr. Donald Macrae (Council Bluffs, Iowa): I do not want you to infer from what I am going to say that I would rush in where angels fear to tread. I take it for granted that in all of these cases we have made a thorough examination and have taken a painstaking and thorough history. I take it we should go into the details of the history, as it only takes a few minutes to do it and it may mean much to us and to the patient.

Where we have ileus in a child we must consider intussusception first. If we have a history that the child has been obstinately constipated since birth, we may think of Hirschsprung's disease or dilated colon. As we go along we will have to consider the question of obstruction or ileus following acute inflammatory conditions in patients from ten to twenty-five years of age. People at that time of life may have a previous history of acute appendicitis or of gall-stones or of inflammatory conditions in the pelvis, and in the female we must consider them. We should go into the history of gastric crises, looking to syphilis. After we have gone through all these things, if we have a patient who has a scar on the belly, whether of five or three years' duration, and who has an acute condition simulating obstruction, it certainly points to bands or other post-operative adhesions. It is true also of gall-stones. We may have gall-stone obstruction, or, as Murphy described it, obturator obstruction from gall-bladder conditions in which we have no history of previous gall-stone colic at all, where the gall-bladder has become inflamed and has perforated into the intestine, and we get a slow obtutator ileus. After we get to the age of thirty-five, forty-five, or fifty, we especially think of obturator obstruction or complete obstruction or car-

cinoma. When these things are all gone through, the personal equation comes in. If a surgeon thinks that such a condition exists he should operate, and I do not believe in waiting for distention because that is a late manifestation of obstruction. We must not wait for these things; therefore, it seems to me, if a man conscientiously believes, after going through these things, that he has an acute belly to deal with, something in there that is apt to kill the patient, it is his duty to operate and find out. I defy any man to make a positive diagnosis in the majority of cases of this type. In obstruction of the superior mesenteric vessels or thrombosis it is hard to make the diagnosis, and such cases usually have some history as a pain or torsion or torsion-obstruction, and if we wait for distention and paralysis of the intestine, we are too late. Really, gentlemen, I prefer making a mistake once in a while in that direction rather than wait to see whether the patient's abdomen is going to be distended or not or if he has a gangrenous bowel.

Dr. Willard D. Haines, (Cincinnati, Ohio): There are two or three factors which I think contribute to the terrible mortality that we have in this type of cases.

First, the time lost between the onset of the obstructive symptoms and recognition.

Second, the time spent by the man in attendance and the time wasted by the patient before he sends for a doctor are important factors.

Third, the time spent in making a differential diagnosis. With the abdomen distended and the earmarks of obstruction before you, it is unnecessary to spend very much time on differential diagnosis. Again these cases have been overtreated. I mean by that, instead of adopting a two stage operation, your fingers fairly tingle to look for the cause of the obstruction at the time of the primary operation. Do not do it. In such cases, with distended abdomen, with entire stoppage of the fecal current, there is but one thing that is going to improve the deplorable mortality in this type of surgery, and that is to make a small opening into the first loop of bowel which presents on opening the abdomen, insert a tube, and get out as quickly as possible. Replacing of fluids lost through vomiting is a very insistent measure in the post-operative care of these patients, as is also the frequent use of the stomach tube. The following day or the succeeding days you may look for the cause of the obstruction by getting all the evidence from the clinical history, physical examination, and the laboratory.

If you do not relieve your patient by this measure in the case I have in mind and am discussing, he will never require further surgery: he will require the undertaker.

I would like to cite a case of acute ileus that I have in mind:

The patient had had obstructive symptoms over a long period of time. He had had a very sharp attack of obstipation in July, 1919, and in January, 1920. He had a recurrence of this trouble in January of this year. In June I was called to see this man who had been acutely ill for seventy-two hours. He had vomited at the begining of the attack, and then vomiting ceased for many hours. I think, about one day. Vomiting began and continued on the second and third days of the attack until I saw him. He had vomited stercoracious material numerous times. He was a large man, and his abdomen was greatly distended, and no feces or gas had passed since the onset of symptoms seventy-two hours before. A rapid enterostomy relieved the situation. A few days later we found an angular carcinoma in his sigmoid, which, in due course of time, was resected and an end-to-end anastomosis made. At a third operation the stoma we had created in the bowel at the first operation was closed, and the man made a complete recovery.

Now, that is just a succinct history of the type of case I am discussing. The doctor in his paper truly has said that some person had slept on the job. Some person should have investigated the obstipation which occurred in 1919 and 1920, and not permitted the final catastrophe, —ileus. With that history there should have been the painstaking examination in January of this year, and one should not have waited for the manifestation of acute obstructive symptoms. This type of case is urgent surgery. The less you do consistent with drainage of the bowel itself, the better for the patient, and the better his chances will be for getting well.

Remember it is not gangrene, neither is it peritonitis, that destroys life in acute ileus; it is stercoremia, and this is relieved by draining the bowel, but we may turn the scales against the patient's chances for recovery by doing a complete operation and removing the cause of the obstruction at the primary operation.

Dr. Elmer T. Twyman, (Independence, Mo.): I would like to make one or two remarks on the interesting paper of Dr. Cottam. In the first place there seems to be a vast difference between cases that occur very high in the

intestinal tract and those that occur low. I have in mind a case occurring in the sigmoid that went nine days without a bowel movement and made a successful recovery. All of us know that very few hours come between the onset of an obstruction high up and the very violent symptoms.

The doctor appears to describe only acute traumatic hernia as compensable. It seems to me that a traumatism which results in the recurrence of a hernia, even though there may have been a preformed sac, should also be compensable. It seems to me also that besides the cases in which the muscle or fascia is directly injured, that there might be those in which a sharp object may impinge upon the nerve supply of the muscle, causing atrophy and weakness with hernia resulting later, and that this also should be included in the compensable group.

As regards treatment: There is one point which I think deserves mention. It should not go by default, and that is a consideration of the chemistry and physiology of this matter. I think if the cases are considered from that standpoint, and the stomach is made empty and sufficient water is introduced into the patient's circulation, the mortality will be very much less. I think a consideration along that line should precede and follow operation. The operation should be made short and in consonance with what the patient can tolerate. Without the introduction of large quantities of water, so that water-balance is restored and toxins diluted, and without keeping the stomach empty, I think the mortality will continue exceptionally high.

Dr. Neil John Maclean, (Winnipeg, Manitoba, Canada):

There is one point I would like to bring up in connection with this paper. This subject was brought before the Association last year by Dr. Robinson, of Santa Barbara, California. Dr. Haines has brought out the point very well of what to do in a very late case, but between the late case and the very early case there are cases where there is a great deal of distention of the bowel.

I never start to operate on a case of acute intestinal obstruction without a large rubber tube about the size of my index finger, and if it is a case that has gone on for some time and there is a great deal of distention, after relieving the obstruction I make a small opening in the bowel and slip this rubber tube over all the distended small intestine emptying it of the pent-up fecal material the toxemia from which is the real cause of the patient's death. The last case I had was one in which the bowel

was obstructed for eight days. The woman was six months pregnant. She had had an appendectomy done and abscess drained five years before. The obstruction was in the ileum. After relieving the obstruction I made a small opening just beyond the point of obstruction, so that the opening was in the bowel that was not distended and not damaged. I use a rubber tube because it is pliable and you can put all the small intestine on the tube. Afterwards I closed the small opening and closed the abdomen with a drain down to the peritoneum, but not into the peritoneal cavity. The patient made a good recovery. This method is not original with myself. I think it is mentioned in Moynihan's "Surgery," but he recommends a glass tube. I use a rubber tube and find it much better because it is pliable, and if long enough to reach to a basin on the floor the siphon action will collapse the bowel as fast as you can thread it over the tube.

Dr. John E. Summers, (Omaha, Nebr.): I should like to say a few words in connection with Dr. Cottam's paper. Dr. Haines in his discussion pointed out the difficulties connected with these cases, and that a good deal depends upon where you open the bowel. He suggests doing the Nélaton operation, proposed by Trousseau in the later sixties. But an improvement has been made in the operation, and it is, to open the intestine as high as possible if the patient is vomiting. The vomiting stops as soon as the bowel is opened at the highest point. Do a jejunostomy.

I had the pleasure of reading a paper on this subject at Montreal last year when the American College of Surgeons met there. I looked up the statistics and gave my own experience. By the way, a Nebraska surgeon invented the best technic for an emergency jejunostomy that I know of. Under local anesthesia make an opening through the right rectus high up, slip your finger around and pull up the first coil of intestine,—that is the jejunum,—make a puncture, and introduce a large catheter and surround it by a double purse-string suture, and drop the intestine. Drainage starts immediately. When an ordinary enterostomy, Nélaton's "first coil," is done, it is hard to tell how much drainage you will get; there will be the passage of some gas and a little drainage. It may be hours before there is any drainage to amount to much.

Another thing: when you open the abdomen secure the first heavy coil,—that is where the fluid is. The lower you go down, the less fluid you have and more gas, because a reverse peristalsis has taken place. The higher up you

open the intestine, the sooner you get drainage and relief. There is no question about it.

Dr. Cottam (closing): I confined my paper to two or three phases of the subject and carefully abstained from going into long technical details. However, I am glad the discussion brought out so many additional points of information to supply the things I did not have time to touch on in my contribution.

DIAPHRAGMATIC HERNIA

ARTHUR T. MANN, M. D., F. A. C. S.

MINNEAPOLIS, MINNESOTA

In the past diaphragmatic hernia has rarely been diagnosed before operation. The majority of the cases have been disclosed at autopsies. Some of them have been found in the course of an operation for other supposed conditions. During the last ten years, with the use of the x-ray, occasional cases here and there have been made out before operation, and they are becoming less uncommon. The x-ray is a great aid. With it one should be able to diagnose nearly every case. However, the attention of the diagnostician must be caught by some feature in each case which calls for Röntgen examination, or it may not be used and many cases will still be missed. The clinical diagnosis is no clearer than it was before.

The comparatively large number of traumatic cases which occurred during the war and the gradually increasing number of cases in which a definite diagnosis has been made with the aid of the x-ray, have led to some excellent papers during recent years. They cover the subject of diaphragmatic hernia so thoroughly and so well that it is unnecessary for me to go fully into all phases of the subject. This leaves me free to present my case and to discuss some of the questions which may be of special interest.

J. K., aged 30, broncho rider, Montana.

Family history: Negative.

Past History: Pertussis at 9: high-explosive wound of the left thigh, fleshy parts, October 1918; high-explosive fragment removed the same day; wound healed.

Present complaint:

1. Stomach trouble.
2. General weakness.

Present illness:

No stomach trouble prior to February 1919; acute appendicitis with abscess operated on February, 1919; patient was in bed until June, and the wound continued to drain pus until July, 1919. During this time he was much troubled with gas, in the stomach and bowels. Caught cold in March, 1919, and had a good deal of cough, spat up as much as three or four cupfuls during a day, but only one or two teaspoonfuls at a time.

At this time he had much pain in the left chest. In April he began to be better, but continued to cough and expectorate until September, 1919. Previous to the operation he weighed about 160 pounds, but after it he lost so that in July, 1919, he weighed only 124 pounds. After this he gradually gained in weight and strength. In October, 1919, he was operated on for a post-operative hernia following the appendectomy.

Following this he felt fairly well, but was still troubled with a good deal of fullness and distress after meals until February, 1920, when the trouble became aggravated. At this time he noticed pain in the epigastrium, left lower chest, and left shoulder. There has been little change in the character of this pain since that time.

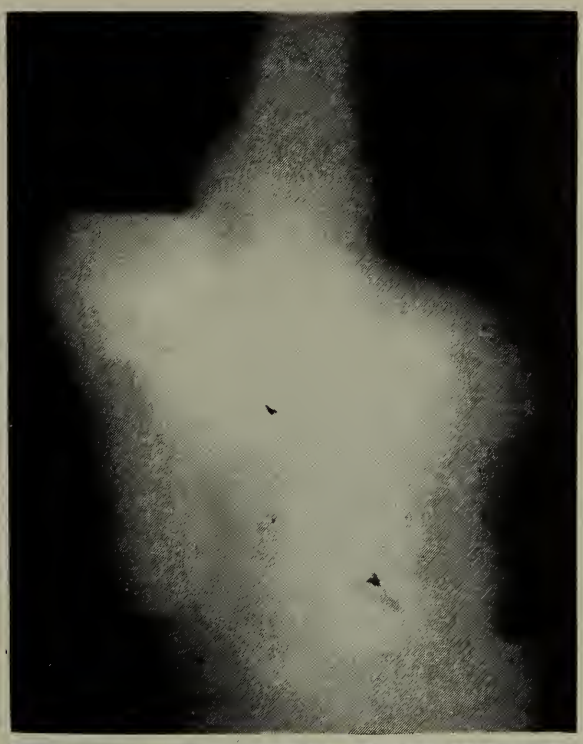
The pain usually starts first in the left shoulder and in the epigastrium. Distress comes usually almost immediately after eating. Liquids often cause much more trouble than solids. He says that when the stomach is bad he has much pain in the lower left chest. When there is much trouble or when he gets to vomiting, his heart pounds a great deal. He feels best lying on his left side with the knees moderately drawn up. There is definite relief on vomiting. He states that he has vomited food eaten thirty-six hours previously. His appetite has been very good since September, 1919; bowels, usually regular; sleeps rather poorly; has been rather nervous since he was taken sick. Weight on admission to the hospital on December 7, 1920, 133 pounds; present weight,, 160 pounds, January 21, 1921.

Physical examination: blood pressure, systolic 100 to 108, diastolic 84 to 92.

Chest apparently negative except for tympanitic note over the left lower chest, heard more prominently at one time than another; also some gurgling in the left lower chest.

Heart, Apparently negative except that the pulse goes up very easily on exertion.

General examination, negative except that the patient is definitely undernourished.



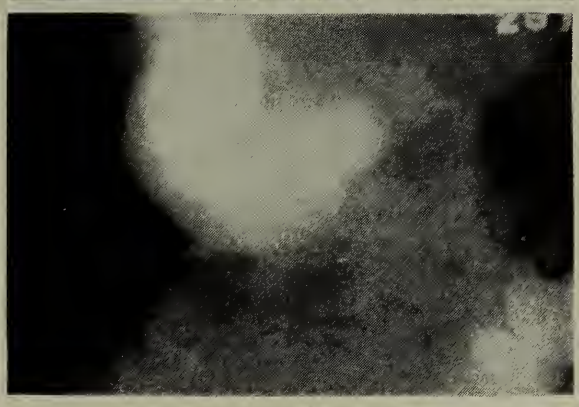


Fig. 1. (above). Dorsal view before operation. This shows the portion of the stomach below the diaphragm filled with the barium meal and the portion above the diaphragm partly filled with a level top under a gas bubble.

Fig. 2. (below). Dorsal view after operation. This shows the normal contour of the stomach restored to its position below the diaphragm.

Blood, negative.

Wassermann, negative.

Urine, negative.

Test meal, total quantity, 60 c.c.; free hydrochloric acid 30, total acidity, 42, trace of occult blood.

X-ray examination of stomach and duodenum:

Shows left lower lung field above the level of the diaphragm occupied by an air bag, which immediately gives an impression of a diaphragmatic gastric hernia. Barium fills readily into the lower compartment below the diaphragm. There is an hour-glass constriction at the level of the dome of the diaphragm through which barium passes with moderate difficulty, and then flows in with a level top under a large gas bubble above the dome. The duodenal cap cannot be definitely ascertained, nor can the flow through the duodenum be seen, but the barium again first appears in the upper loop of the jejunum below the lower half of the hour-glass of the stomach. Occasional peristaltic waves are noted in the walls of the herniated portion of the stomach. The pyloric antrum and duodenal cap appear to be in the region of the spleen, but above the diaphragm. A six-hour residue is present in the stomach, which presents two fluid levels, one in the upper and one in the lower compartment, indicating an extremely narrow hernial opening.

X-ray of colon, negative.

Diagnosis and conclusion:

Diaphragmatic hernia of the lower half of stomach, including the pylorus and at least a portion of the duodenum.

It is interesting to speculate on the probable etiology of this condition and its possible relation to a penetrating abscess of the lung injuring the diaphragm and thus preparing the field for rupture. The most prominent symptoms of which the patient now complains had their beginnings apparently only in February, 1920, after the chest trouble, which had lasted from March to September, 1919. However, the broncho riding which he used to do quite constantly may have started a separation in the diaphragm.

With the first supposition, we should expect many more adhesions in a traumatic hernia, which would increase, to a very large extent, the dangers and the difficulties of operation, but with the broncho as a causal factor there should be few or no adhesions and the dangers and the difficulties considerably lessened.

Operation, January 26, 1921.

Left rectus incision curving well up into the sternal notch. Fully half of the stomach was found rolled up-

wards through a transverse slit in the diaphragm. This comprised the pyloric end and part of the adjacant fundus of the stomach, which, in its slow anterior rotation upwards had dragged the duodenum from its attachments, upwards, through the opening into the chest cavity, so that practically the entire duodenum, as well as the lower half of the stomach, some of the fundus, and part of the omentum protruded through the hernial opening. The omentum was adherent about the opening, both inside and outside the abdominal cavity, for some distance. All other surfaces were free from adhesions.

After the omentum had been thoroughly loosened by finger dissection the portion of the fundus, the pyloric end and practically all of the duodenum, were worked downward through the opening with moderate difficulty. The stomach slowly assumed its normal shape and size without constrictions, though in spots its surface was somewhat roughened where it had been caught by the constriction of the opening.

The slit in the diaphragm extended from near the esophageal opening outwards and a little backwards in the posterior quadrant. This was closed with eight carefully placed chromic gut sutures. The portion of the stomach lying just anterior to this suture line was sewed to the diaphragm for the slight effect it might have against a recurrence of the hernia

No difficulties were encountered except those incident to the placing of the sutures in the great depth of the field, which were considerable. Only a moderate pneumothorax occurred and was very easily controlled by covering the opening.

May 11, 1921, three months and a half after operation, he reported that he was free from all gastric disturbance, could eat any kind of food without distress, has had no vomiting and no pain in his shoulder.

Of late he has not been able to resist riding his pet broncho.

As to the symptoms of diaphragmatic hernia; they will vary greatly according to the size of the hernia, the amount of constriction at the ring, and the organ or organs which are involved. Various abdominal viscera have been found, but the stomach and the colon are by far the most common. The symptoms vary from none at all in some cases, through reflex indi-

gestion to ulcer of the stomach or duodenum, stenosis at the pylorus, cholecystitis, constipation, or obstruction of the bowels. In some cases pressure against the heart displaces it and may give rise to tachycardia, mediastinal discomfort, and dizziness; pressure on the heart and lungs, to dyspnea. Sometimes the position assumed by the patient influences the symptoms.

The physical signs vary. Sometimes there are none to be found. Tympany, sometimes succussion, may be demonstrated where normal lung resonance should be. Occasionally gurgling may be detected. Sometimes these signs will change with different positions or at different times. If the x-ray study is made the findings will, as a rule, be quite conclusive. The arch of the diaphragm will be clear, often higher than normal, and with abdominal viscera protruding through into the thorax. The hernia will nearly always be found on the left, owing to the protection which the firm body of the liver gives to the right arch of the diaphragm.

In regard to the operation itself: there are two methods of approach. Most of the American and British surgeons show a decided preference for the abdominal route. The approach through the thorax brings one into closer reach of the diaphragm and removes the considerable difficulty encountered in placing the sutures in the great depth of the wound by the abdominal route. American surgeons are loath to produce the pneumothorax, which results when the chest is opened, and, if they select this route, they have been inclined to use insufflation anesthesia. However, our experience with chest surgery has shown that the pneumothorax is of slight importance at the time and disappears rapidly afterwards. In large hernias the collapse of the lung has already taken place before the operation is begun.

My own feeling is that some cases will be best treated by the abdominal approach through the left rectus incision down to or below the level of the

umbilicus and extending upwards in a slight curve along the margin of the cartilages into the sternal notch, and some best by way of the chest through a long incision between the ribs, with retractors widely spreading the ribs, which seems to me much better than the resection of long portions of two ribs.

When there are abdominal complications and abdominal adhesions the abdominal route will be chosen. When there are more or less extensive adhesions in the thorax the best approach will be by way of the chest. When both abdominal complications and extensive adhesions in the thorax are present the combined method of approach will sometimes be needed.

NOTE: The patient returned with a recurrence of his diaphragmatic hernia with the upper half of the stomach above the diaphragm and with a recurrence of his former symptoms. This was evidently the result of the broncho-riding he did after returning home. He was re-operated on. This time the herniated portion of the stomach was densely adherent to the lung and diaphragm, which added considerable difficulty to the operation and undoubtedly was a main causal factor in causing an obstinate pneumonia in the adjacent portion of the lung, which followed operation and from which he recovered slowly but more or less completely, so that now he is quite well.

He has had his lesson and now will be cautious about the horseback riding.

DISCUSSION

DR. WARREN A. DENNIS, (St. Paul, Minn): This is such an unusual subject that, it seems to me, anybody who has had any experience should give it.

I had a case of this kind eighteen years ago, but it was before the days of barium diagnosis of troubles in the intestinal tract, so that the diagnosis was not made. The case was extremely interesting, and the symptomatology was very similar to that of the case which Dr. Mann has outlined. Briefly, the history of my case was this: A young man, 18 years of age, was driving a wagon at night on a road in North Dakota when he suddenly met another wagon, and in attempting to pull his team out to one side was struck in the left side by the tongue of the other wagon. He was badly hurt and was confined to bed for a month, but after that time he got about and apparently

was just as good as ever. There were no particular symptoms remaining from the accident.

He was all right for about a year, then he gave a history which parallels somewhat that of Dr. Mann's case. He was riding a pony, and the pony stepped into a hole and threw the young man over his head. He was unable to get up. The next day was brought to St. Paul. I remember the case mighty well because I had not the remotest idea of what was the matter with him. Diaphragmatic hernia was considered at that time one of the rare surgical curiosities and was not given much consideration. He lay in bed flat on his back. He was very cyanotic and his pulse was full and not accelerated. His abdomen was retracted. It was a scaphoid abdomen: the rectus muscles were pulled in upon the abdominal contents but it was not a muscular rigidity. The only clue I could find as to the location of his trouble was a slightly greater sensitiveness beneath the upper end of the left rectus muscle than elsewhere. I am afraid we did not give as much attention to a careful examination of his chest as we should have done. At all events, nothing was made out in that neighborhood.

It was plainly a surgical condition and apparently an abdominal condition. An incision was made through the left rectus muscle. It only took a few minutes to find out what the difficulty was. In this instance there were some adhesions about the organs that went through a rent in the diaphragm, and the negative pressure was so great that I did not dare make the traction on the organs necessary to reduce them. We were in a predicament, and my associate suggested that we make an opening in the chest, and that, if we did this, we might relieve the negative pressure and be able to make a reduction; consequently we did a rib resection, and then it was a simple matter to reduce the stomach, the transverse colon, the great omentum, and some of the small bowel back into the abdomen. The patient's condition was not very good. Instead of taking the time which would have been necessary to suture the diaphragm and which it seemed to me I could not do from below. I packed with iodoform gauze from the pleural side. In spite of the empyema which developed afterward, the young man made a complete recovery and is well to-day. In that instance there was no vomiting. My recollection is there was vomiting just after the injury, but there was no opportunity for him to vomit afterwards because nothing could get past the tight constriction from the opening in the diaphragm.

Within a year or two one of my former associates has had a case quite similar in an ex-service man. In this instance he was able to enlarge the opening in the diaphragm and reduce the hernia without opening the chest and was able to introduce sutures. This man also made a very good recovery.

My idea regarding my case is that the first injury he received was accompanied by some separation of the muscular fibers of the diaphragm, but one which did not produce a complete hernia. The second injury ruptured what little portion of the diaphragm remained, and his hernia became complete at that time.

Dr. Theodore F. Riggs (Pierre, S. D.): I have been especially interested in Dr. Mann's paper because it was my privilege to report a case of diaphragmatic hernia before this Association two years ago. We did not make the diagnosis previous to operation. We should have done so had we had at the time a proper fluorscopic apparatus In fact, I think we should have done so if we had been able to read the plates properly. The fact that Dr. Mann made positive diagnosis before operation impressed me very much. I agree with Dr. Mann that it is rather difficult to close a rent in the diphragm from the abdominal side. I merely wish to add that I received word from my patient within the last fifty days and she is perfectly well.

Dr. Oscar M. Shere, (Denver, Colorado.): I would like to emphasize the relative advantages of fluoroscopy over radiography in the diagnosis of these cases. You can invariably demonstrate the air bubble above the diaphragm and thus clinch the diagnosis with greater certainty than is possible by means of *x*-ray pictures.

I would also make a plea for the thoracic route as the operation of choice in these cases. It is sufficiently well established by this time that the danger from pneumothorax has been greatly over-estimated. Anyone who has endeavored to suture the diaphragm through the abdominal route will appreciate the relative ease in which this may be attained when the operation is carried out from the thoracic approach. I maintain that experience with the thoracic route will find ardent advocates of the method as one of choice in these operations.

Dr. John L. Evans, (Wichita, Kan.) : I wish to make a few remarks about a case that came under my observation four or five years ago. The patient was a young man who fell out of a second story window. He was picked up in marked shock and taken to the hospital,and there it was

found he had sustained a fracture of the left shoulder. On examination we found marked dullness over the left side of the chest, the heart displaced to the right, and the apex beat to the right of the sternum. He had local cyanosis, which is mentioned as one of the diagnostic points of diaphragmatic hernia. He was in great shock. We could not resort to surgery, but on account of dullness in the left side of the chest and his heart displaced to the right, we suspected hemothorax. An aspirating needle was introduced into the left chest, and stomach contents withdrawn. A diagnosis was made from aspiration. The point I want to mention particularly was the marked localized cyanosis observed in the form of a triangle on the anterior surface of the chest.

Dr. John L. Yates, (Milwaukee, Wis.): My experience has been limited to twenty-five or thirty patients suffering from the acute direct traumatic type of diaphragmatic hernia. Three points seem to be noteworthy: First, repair of diaphragmatic hernia is not always possible from below; second, repair from above is easier and safer, and, if repair is at all possible, it can thus be accomplished: third, the usual statements that the acute and the chronic pneumothorax inevitable with thoracotomy performed without differential pressure is innocuous are not based upon fact.

Differential pressure is essential to successful performance of open thoracotomy. Intratracheal insufflation is unnecessarily dangerous. Patients have to be very deeply anesthetized in order to insert the intratracheal tube. Usually deep narcosis is just what should be avoided because both heart and lungs require particular protection. Intrathoracic surgery requires analgesia only, and that to make positive pressure tolerable. The gas-oxygen positive pressure analgesia advocated by Gwathmey is simple and safe. By this means diaphragmatic herniotomy can be performed by the transpleural route more easily and more safely than by the transperitoneal. The ultimate outcome will depend upon re-activation of the diaphragm. Operating transpleurally makes it possible to save branches of the phrenic nerve. At the end of operation the chest is closed with a minimal residual pneumothorax. The post-operative course should be no more distressing than after the transperitoneal operation. Indeed, convalescence should be more rapid, and the final recovery more perfect.

Dr. Mann, (closing): I think probably all the points made by Dr. Yates are correct. My feeling is that with

more experience the route by way of the chest will be used more and more. It is with this, like everything else, we stand-patters are hard to move, so during the war we started off with a left-rectus incision, and not a right one. The pain in the left shoulder is easily explained with this form of hernia, the same as a right pain in the shoulder explains gall-stones. The nerve is the same. The reflex is the same. The branches of the nerve which supplies the diaphragm are the branches of the phrenic, and on each side there are three which run directly out, one runs back and one runs forward. If that general direction is kept in mind these nerves may be missed. The branches going back will not bother us very much. The site of the hernia in my case was not the usual place but back of the midline. Most hernias are on the left side, and many hernias are through the dilated opening in the diaphragm through which the esophagus goes, that is, on top of the dome of the diaphragm, and can be reached comparatively easily through the chest. It can be reached with less difficulty than many cases can through the abdomen. I think this whole thing will be gradually worked out, and the most of the cases will be finally operated on through the chest.'

SCIATIC HERNIA

REPORT OF A CASE COMPLICATED WITH MYXOMATOUS TUMOR OF THE SCROTUM

JOHN EDWARD SUMMERS, M. D., F. A. C. S.

OMAHA, NEBRASKA

Since the publication of the classical article of Garre,[1] in 1892, and that of A. Schwab,[2] in the same year, this type of hernia has been recognized as one with three forms," . . . which pass out both posterior

Fig. 1.—Showing a hernia passing out at the upper border of the pyriformis muscle, and its relationship to the gluteal artery and nerve.

sciatic notches, the greater sciatic notch and the lesser sciatic notch. Anatomically, it is possible for a pushing out of the peritoneum in three places. The greater

ischiatic notch is covered by the pyriformis muscle, which has a small opening or split at both its upper and lower borders. The superior gluteal artery passes out regularly through the upper opening accompanied by a small similarly named nerve, while through the lower opening pass the internal pubic artery and commonly also the principal branch of the ischiaticus, (Fig 1.) Hernias can occur through both openings. The third place in which a hernia can occur is through the smaller ischiatic fossa. In all cases, through whichever opening the hernia passes, it must always have the great or posterior sacrosciatic ligament (ligamentum tuberoso-

Fig. 2.—(Cooper) Internal view of ischiatic hernia. (a) Section of the pubes; (b) Spinous process of the ilium; (c) Sacrum; (d) Iliacus internus muscle; (e) psoas muscle; (f) Pyriformis muscle; (g) Coccygeus muscle; (h) Termination of the external iliac artery in the crural; (i) Beginning of the crural vein; (k) Trunk of the common iliac artery; (e) Internal iliac artery; (m) Obturator artery, which may be traced before the sac as far as the obturator foramen; (n) Internal iliac vein; (o) Obturator vein passing behind the hernia to the obturator foramen; from which another vein (p) is seen passing into the iliac vein; (q) Hernial sac; (r) Its orifice.

sacrum) under it. After passing through one of these openings it makes its appearance in the gluteal fold, under the border of the gluteus maximus muscle. To differentiate a sciatic hernia from a perineal hernia the examining finger can always feel the sacrosciatic ligament above the hernial opening in a perineal

hernia; below, in a sciatic form." Garre compares the great sacrosciatic ligament, in this differentiation, with Poupart's ligament in distinguishing between femoral and inguinal hernia. Although it is generally credited to Sir Astley Cooper[3] to have been the first surgeon to describe a case of ischiatic hernia observed in 1800 (Figs. 2 and 3), a further examination of the literature brings out the fact that an earlier case was reported, in 1750, by a German author of the name of Papen, in a letter addressed to Haller.

We learn from Schwab, whose paper represents the most exhaustive study of the subject of ischiatic

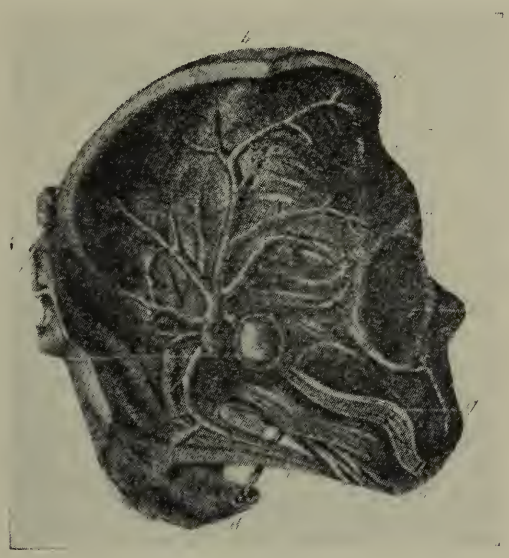


Fig. 3.—(Cooper) Posterior view of ischiatic hernia. (a) Anterior superior spinous process of the ilium; (b) Crista of the ilium: (c) Sacrum; (d) Os coccygeus; (e) One of the sacro-sciatic ligaments; (g) Acetabulum; (g.g.) Sciatic nerve (h) Gluteal artery; (i) Ischiatic hernia sac situated between the artery and nerve.

hernia in the literature, as far as I have been able to study the references, that the etiology of ischiatic hernia is obscure, probably chiefly because of the rarity of its occurrence. There is a marked predominance in females, in proportion of two cases in women to one case in men. This greater frequency is explained by the fact that the ischiatic notch is slightly larger, as well as that the sacrosciatic ligament in women is of greater length and laxity. The hernia occurs more

frequently on the right side than on the left, having been observed there ten times out of fourteen cases. One particularly interesting case of a woman, reported by Crossle,[4] has a clear history as to its etiology, it having developed while the woman was "in the act of stooping and assisting to lift a heavy iron plow into a cart; she became suddenly conscious that something had given away in a situation deeply seated," where she later discovered a small tumor about the size of a pigeon's egg, situated on the margin of the gluteal fold on the same side. This tumor gradually increased in size until, when it was examined by Crossle, it had reached the size of a well-formed fetal head at full

Fig. 4. Drawing of case reported by Crossle.

period. A drawing (Fig 4) made of this tumor and published in the reports of the Dublin Pathological Society, in every respect had the characteristic appearance of an ischiatic hernia, and had served as an illustration of ischiatic hernia, in text-book articles on the subject since Crossle made his report.

Ischiatic hernia is congenital or acquired, never congenital in women, and is most frequently caused in women as a result of the pressure and trauma of labor. The hernia can occur on either side, right or

left, and can contain intestine and omentum and any viscus or organ sufficiently movable to reach and pass out of the pelvic cavity. Of the cases reported by Garre three contained the right ovary and a loop of intestine. Von Eiselsberg[5] reports a case of cut-off (abgeschnurter) intestine as a content of an icshiatic hernia, operated on May 19, 1904. The patient, a child, was a boy one and one-half years old. There was a swelling, about egg-sized, in the left sacral region. Three days before taking the boy to the clinic the swelling had spontaneously enlarged. The tumor was diagnosed as a lipoma, which it was in part. Operation disclosed the swelling to be a lipoma below,

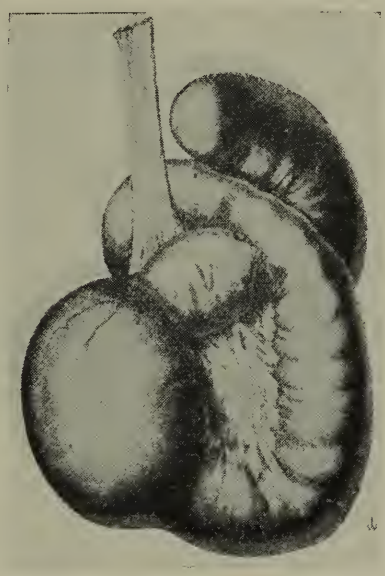


Fig. 5. (von Eiselsberg)

and an ischiatic hernia above, involving the foramen ischiaticum majus. The contents of the sac were a convolution of intestine having two blind, sausage-shaped ends (Fig 5), and communicated with the peritoneal cavity only by a little-finger-sized mesentery pedicle. The pedicle was ligated and divided, and the intestinal coil removed. (Fig 6). The patient recovered

The hernia may be very small and not perceptible to sight, or it may be large. It may vary in size from

that of a chicken's egg to that of a grape-fruit. Such a tumor may be mistaken for a teratoma, lipoma, or spina bifida.

Out of the seventeen cases reported up to the time of the articles by Garre and Schwab, in 1892, eleven of them can be positively stated as being true ischiatic hernia; since that time a few isolated cases have been reported by British and Continental surgeons, and the sum total to-day equals about twenty-five. As far as the available literature at my disposal is concerned, I have been unable to discover a single case reported by an American surgeon. Doubtless, cases have been observed and possibly reported.

Fig. 6.—Probable method of restoration of internal current. (von Eiselsberg).

From the comparatively small number of cases which have been reported, it appears that these hernias, unless they produce symptoms of strangulation, had best be left alone. When from the size of the hernia the symptoms warrant interference, an attempt may be made to close the hernial opening from without. In the presence of strangulation a combined operation (extrapelvic and intrapelvic) should be performed, and the case dealt with on general surgical principles. M. Koppl has noted nine cases of strangulation out of the twenty-five cases published in the literature. Lejars[6] recommends as a technic for operation, first, that an excellent light must be provided because of the deep situation of the hernial ring, and the necessity of avoiding the wounding of important blood-vessels,

which might lead to a fatal termination, and which the methods of exposure, never quite satisfactory, might not suffice to prevent. The incision should be made in a downward and outward direction because the gluteal artery usually crosses the superior border of the sac. This is true in only a certain number of cases, but one can never know in advance the exact type of the hernia. A large incision should be made through the gluteus maximus, and its two flaps retracted in order to expose the subjacent region. The incision

Fig.7.—The scrotal tumor—myxoma.
Fig. 8.—Right ischiatic hernia. Myxomatous tumor of scrotum.

should be made obliquely, following the direction of the muscular fibres, from the posterior inferior spine of the ilium to the lower posterior border of the great trochanter. It is the same incision as that employed for ligation of the artery, only it is made one or two finger-breadths lower. Under the gluteus maximus the sac must be carefully isolated before opening it, and the operator must endeavor to recognize, by feeling with his finger, above, the osseous arch of the great sacrosciatic notch; below, the superior border of the pyramidalis muscle, which obliquely crosses this

deeply exposed region. The sac is then incised and the finger, passing up the neck, enlarges the opening by making gentle pressure downwards and outwards. In any necessary further enlargement of the hernial opening great care must be taken not to injure any of the neighboring arteries. The contents of the sac should be dealt with as in other hernias, and an attempt made to close the opening with the available tissues in the most practical way possible. Should gangrene have already developed, after establishing external drainage the operation should be completed, most safely, probably at a later period, by the abdominal route, in the same fashion as it would be carried out in a similar complication of one of the ordinary hernias.

CASE REPORT

The subject of my observation (Fig 7) was a man, aged 35 years, an iron worker, white. He entered my service in the University of Nebraska Hospital (surgical number 6213), June 17, 1921, for the removal of a large heavy scrotal tumor reaching well towards the knees. This had had its beginning three years before, growing slowly at first, of late, rapidly. Three years previously the patient had been operated upon for an appendiceal abscess—the appendix was not removed. Two months following this operation the patient noticed some bulging in the right gluteal fold; later, an unsuccessful attempt was made to remove the appendix, and a scar of an incission over the bulging, replaceable swelling in the right gluteal fold, indicated that an attempt at exploration had been made, but the man was ignorant as to this. The patient had a right inguinal hernia near the middle line, which was the incision used for the drainage of the appendiceal abscess, and a palpable, intra-abdominal tumor could be felt suprapubically. The swelling in the right gluteal fold had increased considerably in size in the last year.

The past and family history of this man was negative, except for the fact that he had been given to the excessive use of alcoholic drinks. All physical findings were negative except as above stated. Wassermann and other laboratory findings were negative. The large massive scrotum was larger on the right side than on the left. The testicles were in their normal position, and the tunicæ vaginales were evidently not involved. The gluteal tumor, the

size of a medium adult fist, presenting at the gluteal fold, disappeared upon the patient's lying down with the pelvis elevated. It was resonant upon percussion and gave an impulse upon coughing. Gurgling could be felt. It was replaceable, and passed within the pelvis above the great sacrosciatic ligament. In other words, it had all the characteristic phenomena of a true ischiatic hernia. As this hernia was making no special disturbance and it was easily reduced, operation was not deemed advisable because of the other complicating conditions, referable to the scrotal tumor. The scrotal tumor had, to my mind, the external and physical characteristics which we recognize as elephantiasis.

On the twelfth day after admission into the hospital, under ether narcosis, the patient was operated on for the

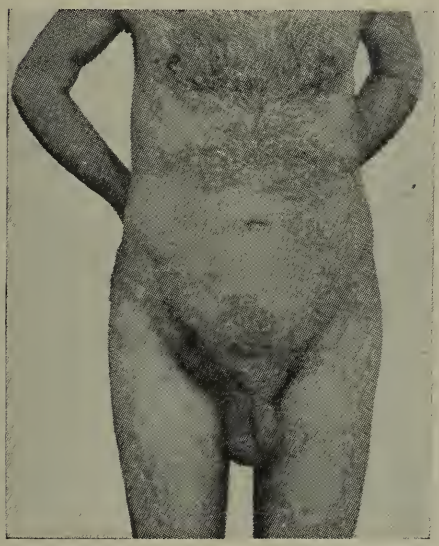


Fig 9.—Showing appearance after removal of scrotal tumor
Fig 10.—Showing perineal tumor which appeared post-operatively.

removal of the scrotal tumor, which was heavy and quite vascular, flaps being formed as deemed best to restore the parts to an approximately normal state. (Fig 9.) An unusual condition was discovered in the carrying out of this technic, which was not easy. The tumor had a pedicle of about half the size of the ordinary man's wrist, which passed up in the perineum between the rectum and the urethra and was a part of the pelvic tumor, which was palpable suprapubically, extending upwards about one-quarter of the way towards the umbilicus. The gross tisues of the tumor, which was heavy and had many blood-vessels coursing through, had much the appearance of the

thick, whitish, watery tissues of the scrotum, seen upon incision into it in instances of extravasation of urine. The wounds healed kindly, and x-ray treatments were instituted for their hoped-for influence upon the remaining portions of the tumor in the pelvis.

The patient was discharged from the hospital July 23, 1921, with orders to report as directed, for observation and x-ray treatment. The man renewed his alcoholic habits and was unreliable and neglectful in carrying out instructions, and, being interested, I had him practically kidnapped when drunk and brought to the hospital for further treatment, as it had been ascertained that the tumor, both perineal (Fig. 10) and pelvic, was enlarging very noticably. He re-entered the hospital September 4, 1921, and it was not until September 19 that he had sufficiently recovered from the effects of his alcoholic poisoning to justify an operative procedure under ether. On this day I removed a considerable mass of the new growth, which had mounted upwards from the perineum towards the right inguinal ring. The incisions employed gave me an opportunity to determine that the pelvic growth was a retroperitoneal one.

The hospital pathologist, Doctor J. J. Keegan, reports as follows:

In gross the tumor consisted of numerous encapsulated nodules, two to ten centimetres in diameter, of moist, translucent, fairly soft tissue. The form was preserved on section. Microscopically this tissue consisted of widely separated spindle and star-shaped cells with processes anastomosing or disappearing in the matrix. These cells were more numerous in the region of the capsule and about blood-vessels. There were varying numbers of blood-vessels with loose mesh adventitia. The matrix of the tumor consisted, in formalin fixed tissue, of a finely fibrillary structure and clear interspaces. A diagnosis of myxoma was made in this case on account of its distinct nodular tumor characteristics, its tendency to recur after operation, and the loose-mesh embryonic connective-tissue characteristic on section.

The particular interest in this scrotal tumor consists in the fact that its growth downwards and upwards into the pelvis, follows the embryonic development of the scrotum itself. The myxomatous character of the tumor confirms its mesodermal origin. The scrotum is mesodermal in origin, and like the

abdominal wall differentiates into the same layers. The best description of the embryological development of the scrotum with which I am familiar will be found in the "Treatise on Surgery"[7] by le Dentu and Pierre Delbet. The formation of the scrotum is independent of the testicular development and migration. "At the beginning of embryonic life the terminal portion of the intestine, the allantois, the canal of Wolff, and the canal of Müller open into a common cavity, which bears the name of *cloaca.* Towards the second month a mesodermic bud (or shoot) is detached from the superior wall of this cavity, which, under the name of *perineal spur* descends vertically and forms a transverse partition. This divides the cloaca into two cells, henceforth separate and independent. The posterior cell is called the *anus;* it is in its interior that the intestine ends. The anterior cell bears the name of *urogential sinus.*" From this latter, develop the urethra, and in the female the labia of the vulva, in the male the scrotum.

I now have this patient, because of his habits, under legal restraint and under my control, and am having the *x*-ray treatment carried out systematically, and hope to be able to report at some future time the disappearance of the pelvic, myxomatous tumor, which I am advised by radiologists should be considered as a tumor favorable to such treatment because of its unlikelihood of metastasizing.

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Dr. Arthur C. Stokes, (Omaha, Nebr.): I saw this case during its progress and suspected in the beginning that the patient had a retroperitoneal myxomatous tumor which was probably malignant, or possibly a retroperitoneal myxomatous tumor from the testicle or of the kidney of a malignant nature, but what is more remarkable is that it is not malignant. It is certainly a case which we watched with the greatest possible interest. It is the only case of sciatic hernia I have ever seen in Omaha.

Dr. Summers, (closing) I would like to know if any one present has seen one of these hernias. I have not been able to find any reports of such cases in the literature of our own country. Twenty-five such cases have been reported in the British Possessions, France, and Germany, and undoubtedly, there must have been some found in this country which have not been reported. At least, I cannot find any reports of them.

INJURIES OF THE FACE AND JAWS

W. T. Coughlin, M. D., F. A. C. S.

SAINT LOUIS, MISSOURI

It is perhaps true that, in order successfully to treat injuries of the face and jaws, a certain amount of special knowledge is necessary. This special knowledge is something that may be easily acquired by any general surgeon who wishes to give it proper study.

For the past few years public attention has been more particularly called to these injuries and to the wonderful skill exhibited by those who were engaged in their repair. This work appeals to the lay imagination, and for that reason prominence is given by the lay press to the success obtained in this branch of surgery.

The results can be seen. Each case becomes an advertisement, and perhaps that is one reason why the general practitioner stands in dread of such cases and why even the ordinary surgeon much prefers other kinds of work. It seems to me, however, that the real reasons why there are so few who adopt this work as a hobby are because it requires a certain amount of artistic talent, and a very great deal of pains-taking attention must be given to seeming trifles from start to finish; the surgeon must have a very thorough knowledge of general surgery, and, besides all this, the financial compensation is usually inversely proportional to the amount of ability and work required.

The surgeon is confronted with an injury to the face. If he would obtain the best results he must

visualize immediately the ultimate result. Every act that he performs from the removal of the smallest shred of tissue to the tying of the last of the smallest sutures must bear upon that result; and in direct proportion to his ability to do this and at the same time observe all of the fundamental principles of surgery, will his results be good.

I have been asked whether one should devote his whole time to this kind of work. That depends altogether on the individual. There are individuals who are utterly unable to do more than one thing well, and there are others who do better work when they have more variety. I think that this kind of work should be practiced as a sort of "hobby" and by someone who is considered by his fellows a good general surgeon. Whether he practices general surgery or not is a matter of his own choice. It is almost certain that those who are not well qualified will not be permanently successful, so that this is a sort of self-limited specialty.

In regard to the variety of wound, whether it be incised or lacerated, there are certain differences in first treatment. Incised wounds of the face anywhere above the level of the gum of the lower jaw, whether they go quite into the mouth or nose or not, should be immediately repaired, and, if below this level, but not opening the oral cavity, they should also be repaired at once. Therefore, all incised wounds may be closed without drainage except those which enter the mouth cavity below the level of the lower gum.

Wounds that cut through the salivary ducts are prone to be followed by fistula formation. To avoid such an unpleasant sequel all that is necessary is to make a passageway from the proximal cut end of the duct into the oral cavity and keep this passage open.

The superficial tissues can then be at once closed, and usually they heal quickly. The newly formed channel should be large enough so that the saliva

discharging from the cut duct can flow at once into the mouth. A little flap of mucous membrane can be drawn into the channel, and its tip fastened to the proximal cut end of the duct. This flap will soon form itself into a tube which will remain permanently patulous.

If the wound above the lower gum level be lacerated or contused it is better practice to close partially, that is, to leave drainage space. Rubber strips make the best drainage material. It is rarely necessary to excise face wounds, and, if excision is ever practised, only a very thin surface layer should be removed.

Wounds which open the air sinuses are likely to cause complications. If such a wound is at once closed tightly some exudate or blood is likely to collect in the sinus; soon suppuration ensues, and the result may be serious. A good rhinologist as a colaborer in such a case is a great help. He can perhaps keep passages open and sinus cavities cleansed, and primary healing is the rule unless the wound is grossly infected from the first. If the infection is certainly established, as evidenced by redness, swelling, etc., by no means should any attempt be made to close such a wound, whether excision is practiced or not. Any wound involving any of the air sinuses may be complicated by cellular emphysema, and it may spread widely. It can be prevented by either leaving the overlying wound widely open or by closing the opening from the sinus into the nose by packing. It is only likely to arise within the first forty-eight hours, unless the patient sneeze or cough or blow the nose a great deal when it may happen as late as the second week, perhaps later. Such actions should be prevented as far as possible.

As has been stated, wounds opening the oral cavity below the level of the gums of the lower jaw should not be at once closed tightly. Many say close partially, allowing for drainage. All of the really dan-

gerous cases I have had and all the deaths were in those who had been "closed with drainage." Therefore, I teach leave all such wounds wide open and see that every recess and cavity in such a wound is loosely filled with iodoform gauze. No one will die of infection and no one will have secondary bleeding, although some may get well with a fistula.

Any wound of face or neck that opens into the alimentary tract must be regarded as more serious on that account. Sometimes the mouth of the patient is altogether filthy, and at all times it is regarded as potentially septic. Pyorrhea and caries are most astonishingly frequent and not confined alone to the lower classes. A dirty wound in the mouth soon gives a foul smell to the breath. Any patient may have a foul breath from causes other than putrefaction in a wound but the stench from a putrefied wound is unmistakable and always a sign of lack of attention.

The mouth and pharynx in patients who cannot eat in the ordinary way can be kept clean only by brush, wash, and gargle.

The cleansing wash or gargle may be any non-irritating antiseptic. The important thing is not what to use, but how and when to use it. The teeth and gums are cleansed three times a day at first, and by a trained attendant; later once or twice daily and the patient may do it himself. The mouth is washed once every hour while the patient is awake, and for the first few days he is awakened every two or three hours at night. After he has washed his mouth he gargles with the same solution. I still use Dakin's solution full strength for the first few days in all cases where oral or pharyngeal mucosa has been wounded. When it begins to irritate it is diluted half, sometimes with KMnO.4 1-2,000 to 1 4,000. Dakin's solution dissolves catgut or silk and may be responsible for bleeding, therefore, when arteries have been ligatured in the wound, it should not be used, Dobell's

solution will do quite as well. When the patient is physically able, he himself is made responsible for the condition of his mouth. There must not be any stench after the patient has been in the hospital twenty-four hours. It is not only on the wound itself that a clean mouth exerts a beneficial influence, but on the general condition of the patient, mental as well as physical.

Foreign bodies should always be sought for if the wounds are deep, whether the wounds are caused by missiles or not. I have removed part of a knife blade from an incised wound. The x-ray may not always show the foreign body.

If a fracture of the jaw complicates a wound of the face, there ought to be no delay in treating the fracture. I have often had much difficulty in getting certain of my colleagues to view this matter in the same light as I do, but I think it is so obvious that a displaced and broken bone should be replaced and retained in position at once that I cannot discuss the matter. It is not so important whether we shall immobilize in open or in closed bite as it is that we shall reduce and immobilize at once. In fractures of bones not likely to be drawn out of position by muscle pull or scar formation, or in those in which malunion or vicious union will not materially interfere with function, this is not of great moment, but in fractures of the jaws it is most important.

There is always the question of what to do with loose pieces of bone and loosened teeth. If pieces of bone are in the wound and not sticking out into the mouth or not entirely free, they had better not be removed at once. Many times have I observed fractures which came diagnosed total loss of substance of the lower jaw for distances up to 2 cm., get well without bone graft of any kind, the repair across the gap being made by new bone formed from the periosteum. Periosteum does form new bone, but only when it is irritated or inflamed. The small fragments

left in situ provoke irritation. The site where they lie should be kept carefully drained, otherwise osteomyelitis will ensue with dire consequences.

Teeth which cross a line of fracture or which are loose at the site of fracture may not cause any trouble, but, as a rule, they prolong suppuration if infection is present. And if suppuration occur osteomyelitis, ending in non-union or worse, may ensue. It is best to take pictures every week, and, if there is any sign of absorption around their roots, remove at once. If any remain loose at the end of three weeks they should be then removed.

There is one fracture in which immediate reposition and retention should never be done, and that is the "craniofacial separation," so called by the French. Here free drainage must be allowed, or meningitis may ensue, and, if the face is pushed and held forcibly against the cranium in reduction, drainage will be interfered with.

It often happens that wounds which are best left widely open till danger of widespread infection or secondary hemorrhage is past, if left to themselves would take long to heal and would heal with great deformity due to retraction of tissues. Healing time can be greatly shortened, and the deformity due to shrinkage can be much prevented, by the use of light elastic traction. It is important that the pull be only slight, but constant. If it is more than just enough the blood supply to the edges of the wound will be interfered with, and they will cease to heal and may even slough.

Crusts should not be allowed to form on wounds. They harbor infectious organisms. Frequent removal is not so good as prevention of their formation. This can be done by spraying once in two hours with hypertonic salt or any of a variety of antiseptics. Dichloramine-T in oil is of value, but it irritates the skin round about.

Whether to use dressings or not is a question the surgeon in charge must decide. If the wounds are not secreting, they heal better without dressings. In fact, I believe almost all wounds heal more rapidly if left exposed, provided the secretions are sprayed away before they form crusts, and the surface is kept warm.

If the edges become infiltrated or inflamed, however, copious wet hot dressings renewed as soon as they cool are indicated. If any redness or thickening with increased tenderness appear at the site of a broken bone, it should be opened to the fracture site as soon as possible. To wait for fluctuation is to court osteomyelitis.

DISCUSSION

Dr. Kellogg Speed, (Chicago, Ill.): I have had considerable experience with these injuries, although I have not been able to follow them through their course as Dr. Coughlin has done. I saw a great many of them shortly after the men were wounded in 1917 at Casualty Clearing Station No. 12 B. E. F., Belgium, where we received head injuries and many maxillofacial injuries. At that time the technic of treatment was not perfectly established in the British Army. A great many of these wounds were debrided with loss of substance and exposure of bone, with subsequent infection and contraction. I recall several I had which necessitated tracheotomy before the patient could be brought to the condition of being able to take the anesthetic. Local anesthesia was not used then. However, later in the British Army, through the efforts of Dr. Kauzaupan, of the Harvard Medical School, these cases were properly cared for and sent as soon as possible to one of the base hospitals. He had as many as 250 maxillofacial injuries at General Hospital No. 120, B. E. F., France, at one time, all of which were treated in accordance with the methods that have been outlined. Remarkable results were obtained in six months, a year or sometimes, eighteen months.

The two principal points are, first, not to débride the tissues and take away a lot of the soft parts; second, where the main portions of the lower jaw are tilted out

of position, one should not allow them to contract too much before the wound is healed. The jaws must be splinted or wired in a normal uncontracted position. Care in feeding and the constant irrigation of the wound will require an enormous amount of patience, but in the end it will repay both surgeon and patient with a much better face.

I do not think one will ever see a better series of pictures of examples of these injuries than we have seen this morning.

Dr. James F. Percy, (San Diego, Calif.): I rise to call attention to a most valuable and important adjunct in the after-treatment of these swollen and edematous tissues following plastics, especially about the face. My present procedure was developed as a matter of necessity following the sometimes extensive removal of the tissues by the cautery in breast carcinoma. The covering of these spaces by various forms of skin grafts was never entirely satisfactory. You can get a much more normal type of covering if vigorous massage of the edges of the wound is practiced for fifteen minutes every day. The value of massage is not appreciated by surgeons in the after-care of tissues that they have transplanted or switched into new locations. If these new tissues, or old tissues in new locations, could be massaged by the surgeon, or by some one whom he had trained after he had himself learned by personal experience what they need for their subsequent normal development, a most important step in the progress of plastic tissue work would come. Inflammatory and cicatricial tissues can be made much nearer the normal by persistently moving them than one not familiar with it would even dream was possible. My aim is to move the tissues, to get them loose wherever they are sticking abnormally. This same procedure is also applicable where they are merely swollen or edematous. It brings back the function that was peculiar to the area to which the tissues have been transplanted. Moving the tissues by pushing, squeezing, lifting, kneading, or, possibly, rubbing, liberates and develops the blood-vessels and nerves, and this means, just in the degree that it is intelligently and persistently carried out, not only a return of function to the part or parts, but a more normal type of tissue than you can not get in any other way.

This treatment will also close many of the persisent fistulas of the gut, bladder, and gall-bladder that are alone due to imflammatory and cicatricial tissue which enclose them and account for their persistence. The forcible

movement or massage of the structures surrounding them will in a very large percentage of cases permit them to close. The point is to keep persistently at all fixed structures, which are normally mobile, until they are freely movable again. Failure to get results merely indicates that the method has not been persistently carried out.

Dr. Coughlin (closing): Débridement in the face is not necessary. Infection of these wounds is rare. Gas gangrene I have never seen in wounds of the face. Tetanus has been thought of, but all patients are treated with antitetanic serum. Immobilization of the jaw is left to the dental colleague. A good dental colleague is a very great help, but a poor one is a thorn in the flesh. Immobilization should take place at once, as it is perfectly ridiculous to wait before applying some form of immobilization apparatus. I do not care whether the mouth is blocked open or shut. All patients are massaged. We had a very high grade of masseurs, and the massage was very well taken care of. I think a good deal of the success in these cases was due to the efficient massage that was given.

A CONTINUOUS KNOTTED LOOP SUTURE: ITS FIELD OF APPLICATION.

JOSEPH RILUS EASTMAN, M. D., F. A. C. S.

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The suture described in this paper was first used to draw together the margins of the wound after breast amputation.[1] Its advantage is that by its use as a relaxation suture the cutting pull or tension on each side of the wound is distributed among several points instead of being concentrated at one point.

In the closure of wounds, the margins of which are widely separated, as in those in which there is an extensive skin defect, sutures which will bring together the wound edges, or skin margins, and hold them coapted, resisting the sometimes unavoidable tension without cutting out, are obviously helpful.

For the purpose of relaxing the tissues immediately along the wound margin, heavy interrupted sutures are usually passed at a distance of 1 inch (2.5 cm.) or more from the wound line on each side, and these, to some extent, take the strain from the coaptation sutures.

Such relaxation sutures, however, do not differ essentially from the coaptation sutures applied closely along the wound margin. Their slight advantage consists in the fact that they are usually of heavier material, and, passing through the skin at a greater distance from the wound, the likelihood of their cutting out is lessened, since they may cut for a considerable distance without splitting the skin quite to the wound edge. If an ordinary continuous suture breaks

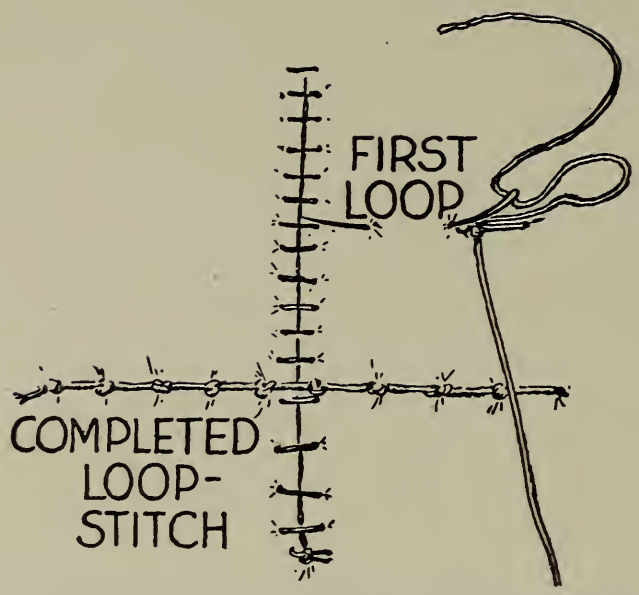

Fig. 1. Method of introducing running knotted loop suture.

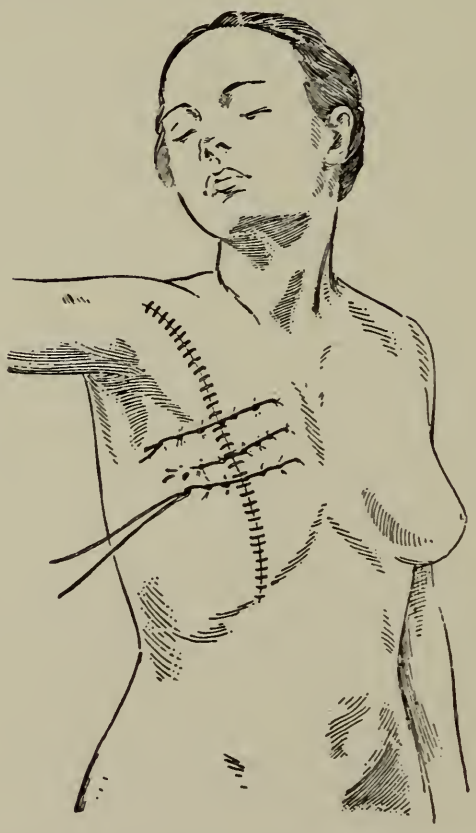

Fig. 2. Running knotted loop suture relieving tension in breast amputation wound.

at any point, the wound margins must fall apart, unless the closure is otherwise reinforced. Here dependence is placed on a single strand. Infection, if it should occur, tends to travel along a continuous suture. These perhaps somewhat captious objections do not apply so clearly to interrupted sutures.

By most surgeons it is felt that accurate approximation of wound edges, particularly after operations for malignant disease, is very desirable. Until more is known of the origin and nature of cancer, the lurking possibilities of a granulating surface with its embryonal cell elements will occasion uneasiness until healed over. Even skin grafts with their active cell proliferation can hardly have the confidence that is given to normal skin. The practice of approximating the wound edges by separating the skin from its attachments over a large area with consequent diminution of blood supply is not infrequently followed by sloughing, which greatly increases the difficulties which militate against primary covering of the defect.

Clearly, it should be the maxim of every surgeon to have no thought of the covering of the defect while engaged in the radical removal of every vestige of malignant or suspected tissue. The manner of repairing the defect is a matter of no importance until the operation proper is complete. When a thorough operation, however, has been completed, at least a part of the defect can always be covered by precise coaptation of wound margins without unsafe tension.

The running loop suture shown in Figures 1 and 2 holds the margins together more firmly than any relaxation suture with which I am familiar; moreover, it will not cut out unless the pull is very great, indeed, for here the tension is distributed over many points, instead of two, as in the case of ordinary relaxation sutures. In the case of the running loop suture shown in Figure 1 there are nine loops; therefore the tension is divided among ten points, and, if several sutures of this character are used to reinforce the coaptation

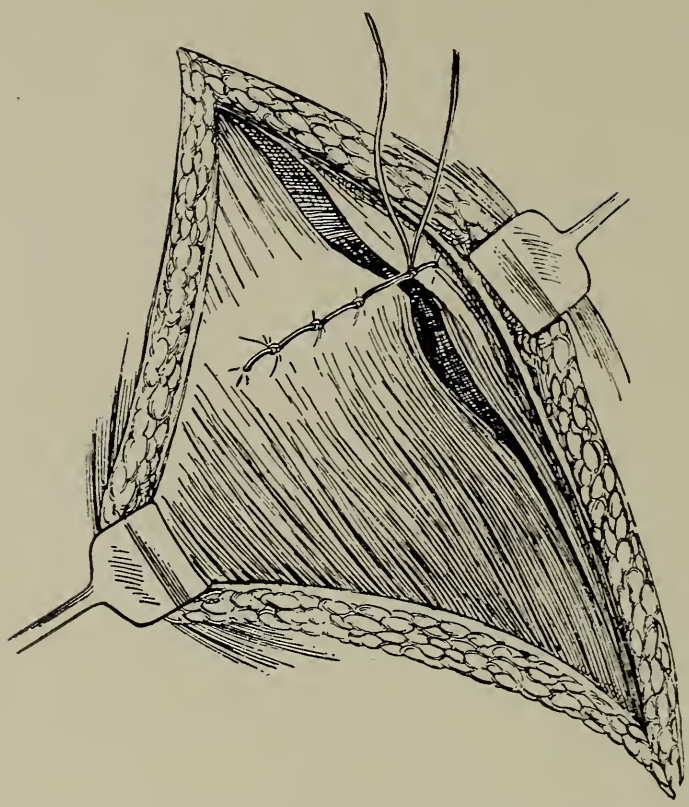

Fig. 3. Continuous knotted loop suture approximating conjoined tendon and Poupart's ligament relaxing tension.

Fig. 4. Running knotted loop suture used to control bleeding before abscission of omentum.

sutures, the wound margins, for example, after a breast amputation, may be brought together under tension without subsequent separation and without cutting out of the sutures.

In breast surgery these relaxation sutures can be applied best after the wound edges have been coapted in the customary manner. They are introduced in much the same manner as a sewing machine applies the chain stitch, but differ from a chain stitch in that each loop is secured by a "hard" knot before the next loop is taken.

Beginning about 2½ inches (6.3 cm.) from the wound margin, the needle is passed under the skin in the direction of the wound edge and brought out about 1 cm. (⅜ inch) nearer the wound edge than it entered. The long suture is drawn through to a point near its middle and tied with a reef or hard knot, as if one were tying off a blood vessel, the knot falling over the aperture of exit or the opening nearer the wound line. In other words, the suture is passed under the skin for 1 cm. (⅜ inch), and both ends are tied over the opening next to the wound. The needle is then passed back through the hole under the knot for the second loop, and the long ends are tied again over the opening at which the needle emerges. The loops are carried across the wound line, and as many are taken on the opposite side as the tension that is to be overcome makes necessary.

It is customary practice to apply two or three such knotted chain sutures after breast amputations if there is considerable traction on the coaptation sutures. Three, about 1 inch (2.5 cm.) apart, placed where the traction is usually greatest, that is, nearer the middle of the wound line, usually suffice.

The knotted loop suture may be utilized in drawing the internal oblique and transversalis muscles to Poupart's ligament in cases of very wide inguinal hernia (Fig. 3). Likewise the conjoined tendon may be drawn and held to Poupart's ligament if several

loops of the chain stitch are applied across it. Whereas an ordinary suture in hernia with wide separation often simply splits off a narrow ribbon from the edge where the needle perforates the internal oblique and transversalis muscles, the knotted loop suture will pull over the whole muscle mass without injury.

The splitting of the conjoined tendon for the purpose of relaxation, and the division of the rectus sheath with or without transplantation of the belly of the rectus, while they are helpful practices in some cases, may be dispensed with often, if the knotted loop suture here described is used.

Fig. 5. Knotted loop suture used to control hemorrhage in mesentery before resection of intestine.

The continuous knotted loop suture serves admirably to tie off and secure the blood vessels in a mass of omentum before its abscission (Fig. 4). Here it is just as efficacious as a series of interlocking ligatures embracing the entire thickness and width of the omentum, and can be introduced in about one-third the time consumed in applying the ordinary interlocking loops. A similar use of the continuous knotted loop suture consists in its application to secure the blood vessels of the mesentery before resection of the V-shaped

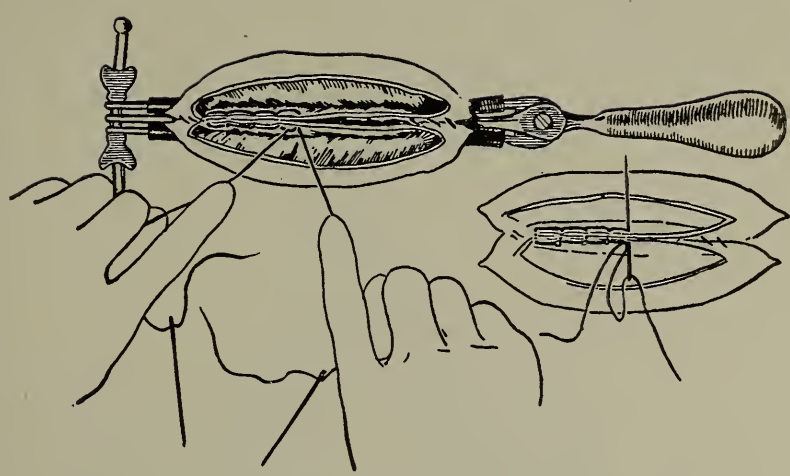

Fig. 6. Simple over and over suture for control of bleeding of mucous membrane in gastro-enterostomy.

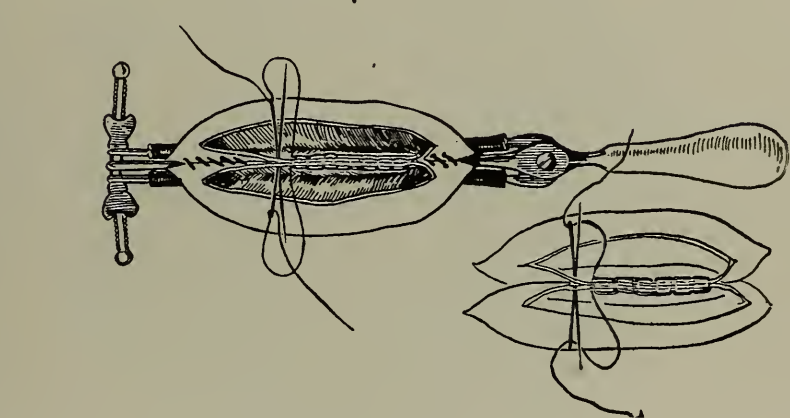

Fig. 7. Cobbler's stitch in gastro-enterostomy.

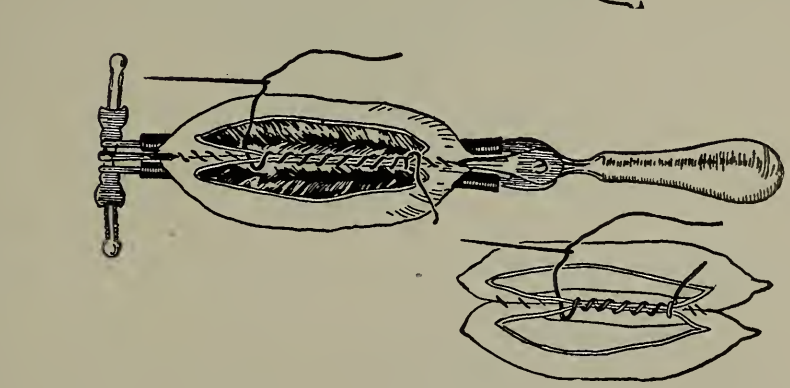

Fig. 8. Author's running knotted loop suture for control of bleeding mucous membrane in gastro-enterostomy.

piece of mesentery along with a segment of intestine in resection of the intestine (Fig. 5). The continuous knotted loop hemostatic suture traverses the entire length of the V-shaped incision. It provides perfect hemostasis, and its introduction in the mesentery is very simple and expeditious.

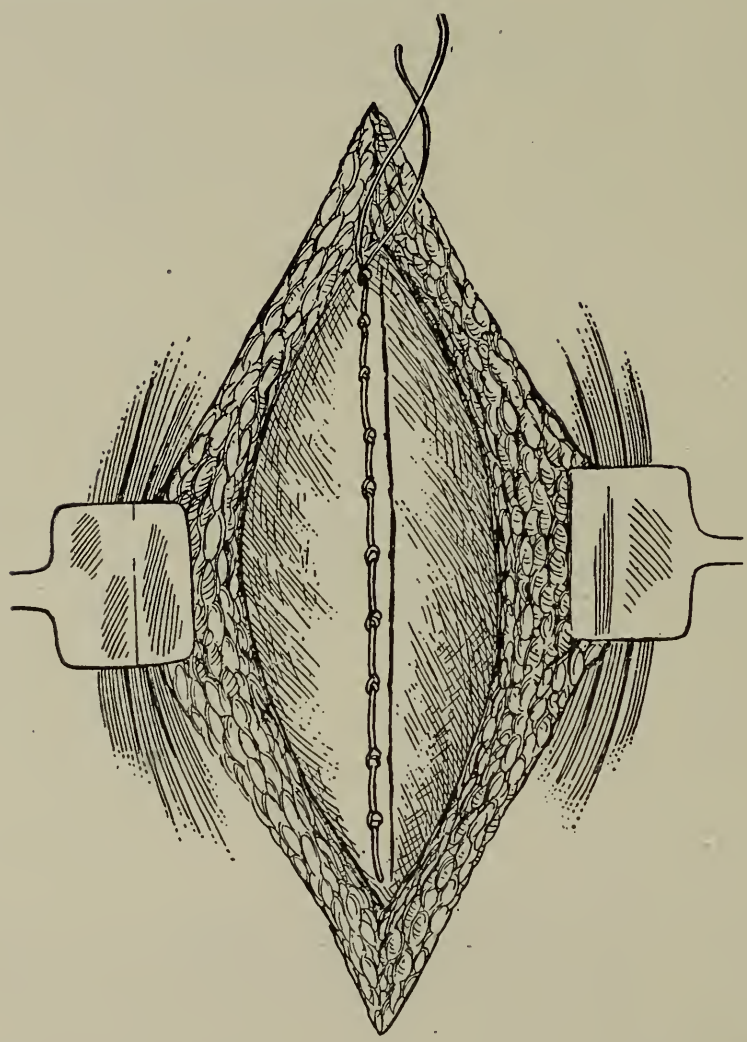

Fig. 9. Knotted loop suture closing fascia in abdominal wound.

I have used the suture a number of times for the through and through suture or hemostatic suture of the mucous membrane in gastro-enterostomy. Most surgeons at this time have abandoned the simple over and over running suture of catgut as the hemostatic suture in this operation, preferring for this use the cobbler's

or harness maker's suture. The author's knotted loop suture will accomplish all that is accomplished by the cobbler's stitch; it will give even greater security against bleeding, and it is introduced more quickly and without the annoyance that is caused by using the suture with a needle at each end, (Fig. 6, 7 and 8).

In closing the fascia of abdominal wounds, one hardly dares to trust to the ordinary continuous single

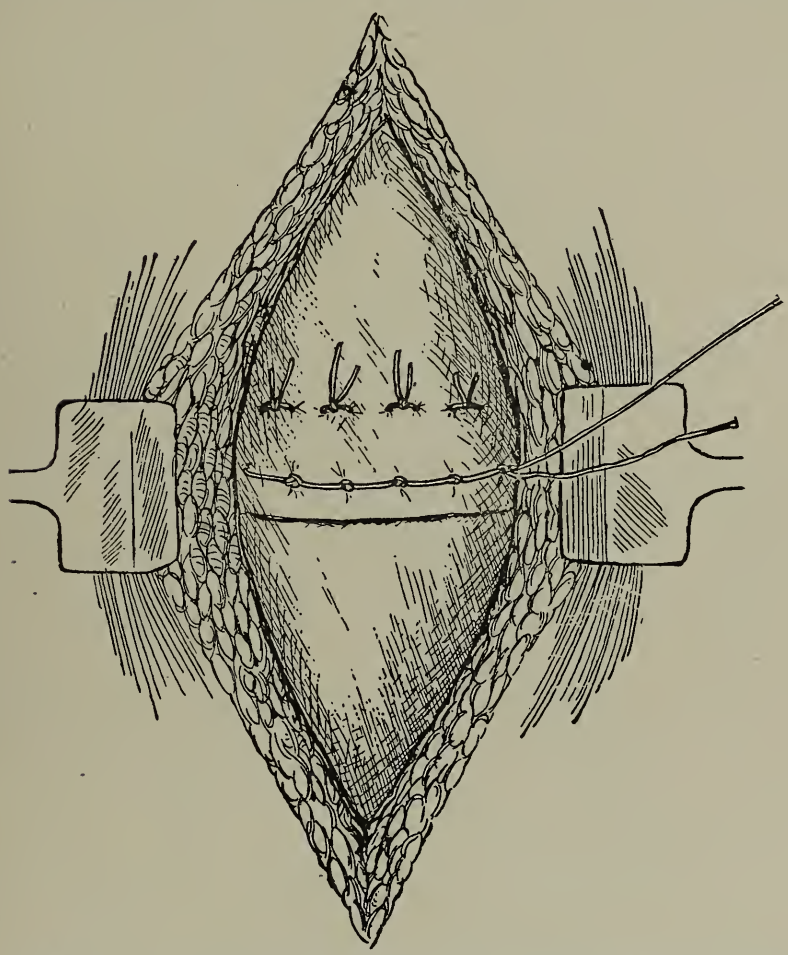

Fig. 10. Continuous knotted loop suture sewing down overhanging apron of fascia in Mayo operation for umbilical hernia.

strand suture, which, if it breaks at one point, permits opening of the entire length of the fascia wound. Here the knotted loop suture gives all the security of interrupted sutures, and is applied almost as quickly as a continuous suture (Fig. 9). It may be used likewise

to sew down the overhanging apron of fascia in the Mayo operation for umbilical hernia (Fig. 10). It is, of course, applied after the stout mattress sutures have been tied. If one desires to use a circular hemostatic suture to provide a local area of ischemia in the scalp before operation on the cranium, in order that the horseshoe incision within this area may be bloodless, the knotted loop suture fits this purpose admirably, giving better control of hemorrhage than the drop-back continuous chain stitch used by Heidenhain for this pur-

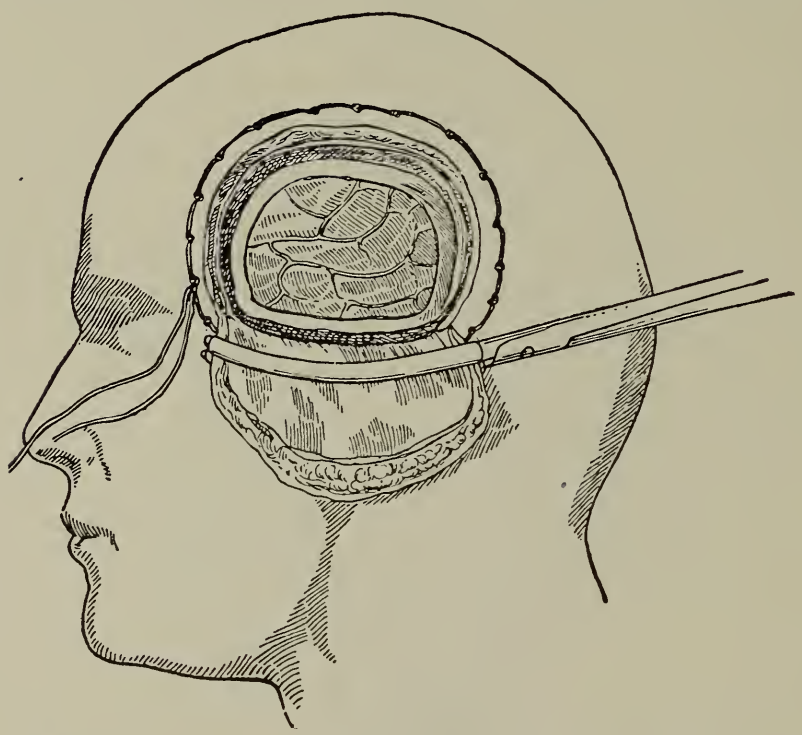

Fig. 11. Circular running knotted loop suture to provide area of ischemia in cranial operations.

pose. (Fig. 11.) It is not always prudent to use such a suture to provide this ischemia of the scalp before operating. In some cases it will be found that at the close of the operation when such a suture is removed, an additional twenty minutes or half hour must be consumed in tying every tiny bleeding vessel of the scalp, whereas, if mouse-tooth forceps had been applied at the outset, and left in place during the operation, there would be little time consumed in ligating vessels. However, if it is desired to get into the

cranial cavity quickly and without bleeding, the use of the circular continuous knotted loop hemostatic suture, with a soft jawed rubber covered clamp applied across the base of the flap, will obviate the annoyance of scalp bleeding.

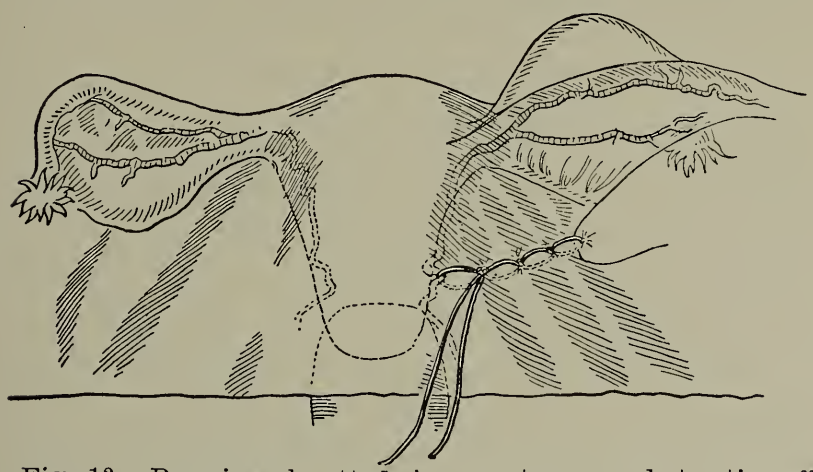

Fig. 12. Running knotted loop suture used to tie off the broad ligament in subtotal hysterectomy.

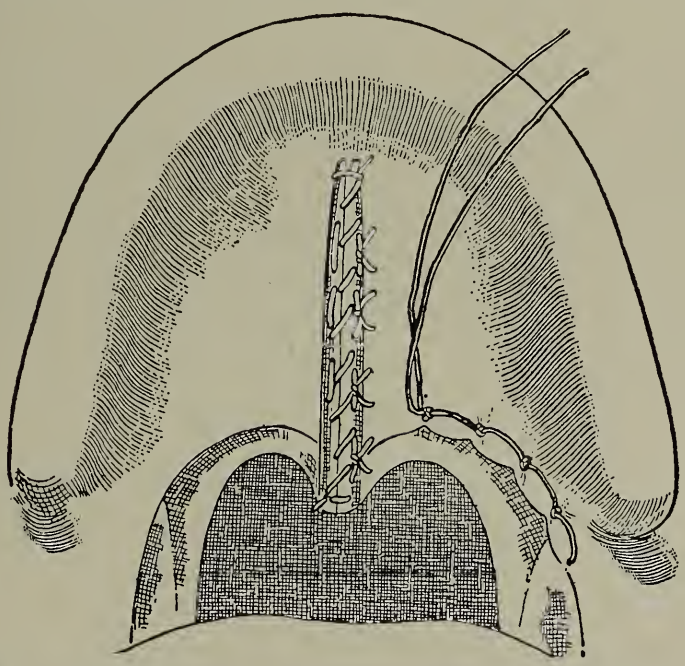

Fig. 13. Running knotted loop relaxing tension in operation for cleft palate.

Another use of the knotted loop suture is made in tying off the broad ligament as in subtotal abdominal hysterectomy, (Fig. 12.) In those cases in which it

is desirable to use the clamp method and tie off the broad ligament with several loops of catgut, the single running knotted loop suture can be applied very quickly and securely, the first loop embracing the artery of the round ligament and the ovarian artery, and the last loop securing the uterine artery.

In the Langenbeck or similar flap operations there will be much less likelihood of separation of the wound margins and consequent failure of union if the mattress coaptation sutures, after being reinforced by a simple running suture, are further supported by a continuous relaxation suture passing round the free edge of the anterior palatine arch[2]. (Fig. 13.)

The anterior part of the soft palate for a distance backward of 8 or 10 mm. (9/32 or 3/8 inch) from the edge of the hard palate contains practically no muscular fibers, being composed almost entirely of palatine aponeurosis. Therefore the anterior portion is much less movable than the rest of the soft palate. The tensor palati acts on this part of the palate, but as this is usually divided when the Langenbeck flaps are dissected up, it is not an important factor in causing separation of the wound margins. The posterior and large part of the soft palate contains muscular fibers in abundance and is freely movable, being the portion on which most of the palatine muscles act. The supporting or relaxation suture referred to follows the course of the palatoglossus muscle or constrictor isthmi faucium. As a rule, the use of this arch suture obviates the division of the levatores palati and palatopharyngei muscles. This affords a decided advantage, since the section of these muscles reduces the blood supply to the flaps and can have only a harmful effect on subsequent phonation.

The running knotted suture is introduced by passing a small curved needle bearing the long linen or hemp thread through the edge of the anterior palatine arch on one side near its base,—that is, near the side of the tongue. The thread is drawn through to its middle

and secured with a reef knot leaving the tail of the suture long. At a distance of 3 or 4 mm. (1/8 or 5/32 inch) from the first or outermost knot the needle is again passed through the edge of the arch; the tail of the suture is taken up, and another reef knot tied. This process is continued around the anterior palatine arch to its base on its opposite side, the suture crossing in front of the base of the uvula.

Such a suture immobilizing the anterior palatine arch reinforces the coaptation sutures against the traction incident to deglutition. In cases in which there has been failure of union in the anterior part of the soft palate, the use of the arch suture described has established union of the posterior part of the soft palate, followed promptly by closure through granulation of the forward defect. Such a suture is much more secure than the mattress suture for the reason that tension is distributed over eight or ten points instead of but two, and the danger of cutting out is proportionally lessened.

DISCUSSION

Dr. A. E. Benjamin, (Minneapolis, Minn.): I am very much interested in this loop suture. A number of years ago I did considerable experimental work on dogs to determine what was the best method of controlling hemorrhage and of preventing pulling out of the sutures and to save time. We know that the tying of each loop or stitch consumes a great deal of time. In the majority of cases you get good results by continuous suture, but in my experimenal work I found in a certain number of cases we had extreme hemorrhages. At the same time, when we were doing this experimental work we determined what kind of suture,—silk, linen, or catgut,—would serve the best purpose. Incidentally I will say that we found at the time that silk or linen suture put on the outside caused trouble. If put on the inside it soon sloughed into the bowel, and we got no ulcer or other complications from the gastro-intestinal anastomosis. We discontinued the use of linen on the outside in doing a gastro-enterostomy on the human being. The Heidenhain suture was practically the foundation for our work in making the lock stitch. We inserted the suture, not anteroposteriorly, but diagonally in the manner I show

you. We put the stitch through in this manner (indicating) through all coats and brought it out here (indicaing). We then passed it over this way and put it back in this manner. We found in our experimental work that by continuing this on going across and looping diagonally we had no hemorrhage at all. The sutures did not slip, and we adopted that method in closing various wounds where we wanted to control hemorrhage. With Dr. Eastman's suggestion, it seems to me, we can use that in like manner for approximating wounds.

BLOOD PRESSURE IN SURGICAL CASES*

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Blood-pressure readings are of considerable value in surgical diagnosis. As an isolated entity one cannot place very much reliance on these findings. The reason for this is founded on the statement that blood-pressure readings are but one factor in a very complicated ensemble, that is, blood pressure is influenced by vasoconstriction and by blood volume. Blood volume is compensated for in many conditions by drainage of fluids from the body tissues; therefore, in any case where hemorrhage is suspected, but not actually visible, we must take into consideration, not only the blood pressure, but the vasoconstriction and the degree to which the loss of blood volume has been compensated by the advent of body or tissue fluids into the circulation. Vasoconstriction can usually be determined by the color of the skin, by the appearance of superficial vessels, and by the temperature of the skin if one makes correction for loss of temperature due to sweating.

The concentration of the blood is usually best measured by hemoglobin determination. Immediately following hemorrhage of an acute character there usually is little, if any, change in hemoglobin for a period of about seventy hours. At that time the dilution of blood with fluids either from tissues or other sources is marked. The blood-pressure findings are of value when the other factors are known.

Pallor with normal hemoglobin indicates small blood volume, but pallor with low hemoglobin indi-

*Read by title in the author's absence.

cates a relatively large blood volume with low hemoglobin. The pallor is not identical, but, while it is possible to recognize it, it is difficult to describe it. We might say vasoconstriction and dilution of blood are nature's compensation for hemorrhage. These compensating agents are capable of acting for a time, but whenever the intense vasoconstrictions fail, if not compensated for by dilution, then a sudden fall of blood pressure may ensue. This is the explanation of the sudden collapse and death of patients who apparently have withstood the effects of severe hemorrhage for some time. I have seen a patient whose blood pressure was good, whose condition did not seem alarming, and from whom no bleeding had occurred for some time, suddenly collapse as though a new hemorrhage had occurred. As a matter of fact, no new bleeding had occurred, but vasoconstriction had failed. Ether and operative procedure are very apt to provoke just such a collapse and should remind us that operative interference, usually imperative, is not without its danger.

How far vasoconstriction may compensate blood pressure is illustrated in the following case:

Miss J. R. had suffered from repeated and severe hemorrhages from the uterus on account of a submucous pedunculated fibroid On April 9, 1922, she lost what was estimated to be a quart of blood. I saw her on that day. Her hemoglobin was 45, her blood-pressure was 128-70, and she presented the picture of extreme vasoconstriction. Her blood volume was very small, for 350 c.c. of blood transfused from her sister with a hemoglobin of 90 raised the hemoglobin content of the recipient to 60 per cent. In spite of the increased volume, the blood pressure after transfusion was 120-80. However, the capillaries of the face and ears became filled with blood, and the patient actually looked flushed. On April 11, 1922, the patient's blood pressure was 100-55, and her hemoglobin 44. On this date her color was better than when she had the same hemoglobin with the vasoconstriction present before transfusion. She felt somewhat weak, but infinitely better than before. Ultimately she went on to marked improvement. The fibroid was removed at the time of the transfusion, and no more bleeding occurred. The operative effect of the snipping of the fibroid was neglig-

ible. I feel certain had the case been allowed to proceed she would, without additional hemorrhage, have collapsed suddenly when the vasoconstriction failed.

Another example is in the case of E. T.:

On May 19, 1921, she was struck by an automobile and suffered a fracture of the skull and a rupture of the spleen with severe hemorrhage. Her blood pressure was 75-40 and pulse 110 on admission. She was in intense vasoconstriction and looked like shock. On May 20, 1921, her blood pressure was 102-70, pulse 106, and hemoglobin 75 per cent. Her increased blood pressure was due to vasoconstriction at the time the spleen was removed, bleeding vein ligated, and hemorrhage stopped. On May 21 her blood pressure was 130-90 and pulse 100, twenty hours after operation, and her hemoglobin was 75 per cent. On May 24 the hemoglobin was 65 per cent and pulse 84. It was not until then that compensation from bodily fluids was manifest. On June 28 her blood pressure was 125-90, hemoglobin 80 per cent, and pulse 88. In this case we actually operated at a time when vasoconstriction had almost controlled bleeding but before failure of the agent.

Perforated gastric ulcer is usually at some time characterized by low blood pressure. This is usually early, and later spontaneously is compensated in some manner. As an example I cite the case of J. F., who suffered a perforated ulcer on September 19, 1921, at 1:10 A. M. His blood pressure soon afterwards was 75-40 and pulse 80. He was operated on (gastro-enterostomy and closure of perforation) on Sept. 19, 1921, before he had fully reacted. His blood pressure on September 20, 1921, was 130-90 and pulse 84. This patient would, if not operated on, probably have shown a spontaneous rise of blood pressure, as was the case in E. R. G. On my first visit the blood pressure was 130, although immediately after his attack it was so low that I have not felt it could accurately be recorded. I do not believe blood pressure gives any index to prognosis unless taken at all stages of a perforated ulcer, as spontaneous rises have occurred in fatal cases.

A low blood pressure in ruptured appendix, I believe, prognosticates an unfavorable outcome. Some

of these patients with fairly good pressures at the time of operation have died. Recovery from a low blood pressure due to sepsis has not come under my observation.

Ruptured ectopic pregnancies usually come to us after repeated hemorrhage. I recall one case with a blood pressure of 130-60 and a hemoglobin of 40 that was suffering from air hunger and seemed at the point of death. Clamping vessels and transfusion raised the hemoglobin only eight points, so that the blood volume was fairly good. In spite of threatened respiratory collapse the patient recovered.

In a very acute hemorrhage from the femoral artery, the blood pressure was almost direct indication of the patient's condition. This patient's blood pressure was almost impossible to get and for two hours after application of the tourniquet remained stationary. The hemoglobin was 95, and the blood pressure immediately returned after transfusion of 800 c. c. of blood. In this case a suture of the artery was done successfully, and the patient left the hospital in twelve days in good health.

In brain injuries the blood-pressure findings alone are not conclusive. In five cases of bleeding from the middle meningeal careful blood-pressure records were kept. In two of them the pulse pressure,—that is, the difference between the systolic and the diastolic pressure,—was very great—in fact, more than twice the pulse rate. In the other three this did not hold good. For example, Patient B. had a blood pressure of 160-112 and a pulse of 58. Operation showed an enormous hematoma about the ruptured middle meningeal. The pressure was extreme, yet some other factor, possibly shock, destroyed the typical ratio we expect to find.

A high pulse pressure unassociated with slow pulse has occurred in some of our cases of brain contusion. Patient S. had a blood pressure ranging from 132-45 to 130-30, but the pulse was 85-100. This man show-

ed some mental confusion, but there was no choking of the discs beyond a slight papillo-edema. He made a perfect recovery in a few days. Most of the severe lacerations of the brain show a rapid pulse and low blood pressure, attributable, I believe, to coincident shock.

In conclusion, I wish to state that consecutive blood-pressure determinations taken throughout the course of any surgical case are of value both as to prognosis and as to time of operative interference, provided due weight be given to other compensatory factors.

THE RECOGNITION AND TREATMENT OF POST-OPERATIVE COMPLICATIONS

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ST. LOUIS, MISSOURI

The comparatively brief stage in the operating-room is but a major factor in determining the degree of success and is vitally dependent upon the stages that precede and follow it.

Manual dexterity, faultless technic, and rare surgical judgment are invaluable assets, yet they may all fail miserably if preceded by a careless diagnosis and preparatory neglect, or if followed by stupid post-operative supervision. No other calling exerts so steady a demand upon the resources of the individual as does the one dealing with the various phases of health and life, and in no other activity is the neglect of detail and thoroughness so summarily punished.

The most dramatic moment of an operative case often develops in the presence of a post-operative crisis, where the reflection of pre-operative neglect is evident; that this may be avoided, so far as is humanly possible, several precautions are essential.

1. Thorough preparation of the surgeon.
2. Diagnosis based upon a complete history, thorough physical examination, and laboratory findings.
3. Careful preparation of the patient.
4. Commendable surgical judgment and operative technic.
5. Intelligent post-operative care, both immediate and remote.
6. Zealous subsequent observation and detailed instruction during period of convalescence.

There is no permanent standard by which a surgeon may be measured. Fortunately for our posterity, surgery is a progressive science. Theories that at the time appeared unassailable, and operations and treatments that but a few years ago were deemed as stable as mathematics, are being daily laid aside, where they rest as stepping-stones to the physician of the morrow. Certain medical truths, nevertheless, have lived from the time of Galen and Esculapius, and to these have been added the notable achievements of other pioneers of medical progress which will indelibly impress the students of the future and so illuminate their paths that perfection may in time be approached.

From the day of "The Barber Surgeon" until recent years, technical skill was considered paramount. We are being taught by our errors that most of our ills are preventable, and it is fair to assume that in the not far distant future our profession will be utilized by an educated public in conserving their health by preventing illness rather than for the purpose of fighting illness to regain such a part of health as may have been untouched by disease. The writer's hope is modest in that he desires this superficial review of a gigantic subject to emphasize the true relationship between unhappy surgical results and their preventable, pre-operative and post-operative causes.

I. THOROUGH PREPARATION OF THE SURGEON

It can hardly be denied that fewer errors in diagnosis will be made, less operative trauma inflicted, better surgical judgment displayed, fewer post-operative complications experienced, and, consequently, more satisfactory end-results obtained, if the surgeon possesses the requisite knowledge and ability to make these accomplishments probable. If, in addition, he shows sufficient interest in each case to supervise the preparation and after-care to the extent that the dangers of routine are avoided, and realizes that, poor or rich, each individual patient is entitled to

his most thoughtful efforts, he will possess the essential attributes of a surgeon.

II. DIAGNOSIS

So replete is medical literature with articles upon the value of accurate diagnosis that it need be mentioned herein but briefly. Whether the ailment be obscure or evident, a penetrating history is valuable. A complete routine examination, including history, physical and laboratory, for all but urgent cases, so often leads to unexpected and even startling findings that one misses much of the charm of the game, and not infrequently endangers the patient if one relies on less complicated, rapid methods. As previously stated, the ultimate success of an operation is so tremendously dependent on the work applied before the operating-room stage is reached that, to carry out the design of this article, the little and seemingly insignificant attentions must be generously treated. It is during the less heroic stages, before and after operation, that many of the more serious complications are invited or discouraged, and failure to recognize this truth will exact its toll of regret.

A positive pre-operative diagnosis in all but dire emergencies is essential, for a seemingly simple case, under the search-light of careful scrutiny, may surprise even the pessimistically inclined investigator. Nor must the tendency to procrastinate, in the presence of unmistakable clinical symptoms, be permitted to delay operation for the development of the finer points of diagnosis.

Emergency surgery belongs in a somewhat separate category. Haste may be essential. It requires the clinical eye, the experienced touch, and the courage to act promptly and thoroughly with such information as can be exacted without subjecting the afflicted to delay that may prove fatal. Yet even in the presence of dire emergencies certain precautions that will be helpful are not to be scorned.

We have long been in error in assuming that nature has kindly divided the ills to which flesh is heir into two distinct classes,—medical and surgical. No such an alignment is possible, nor is it fair to the ill to presume it. In the building of a house the work of the various artisans interlaces from beginning to end, and the home of the soul is incomparably more intricate. Why should one hesitate in the face of even the slightest obscurity to invite the aid of the fellow who has been trained to view from a different angle and to seek all possible aid in unravelling the Gordian knot of diagnosis.

All surgeons have operated at times with a twinge of conscience. All internists have at times caused harmful delay. It is neither wise nor progressive, and is as inexcusable as carelessness, to assume an unwarranted confidence in one's ability to read and interpret. Such preventable errors strike deeply at the reliance we wish the public to have in our profession and encourage them to seek the advice of the mechanical and spiritual healer. We travel together toward the same objective. Only selfishness, ignorance, or avarice can explain one's desire to journey alone when the interests of the patient can be enhanced by counsel.

III. PREPARATION

A thoughtful diagnosis is a major portion of the preparation. The laboratory findings will present the blood and urine picture, and the physical inspection will establish the degree of resistance or warn of inherent infirmities that require correction before proceeding.

The direct cause of a post-operative complication is often latent in the preparatory stage. It should be discovered and the consequent danger thereby anticipated. Pre-operative conditions that may develop post-operative complications are as follows:

1. Hemophilia.

2. Lung and pleural complications.
3. Pyelitis and other nephritic disturbances.
4. Heart disease.
5. Imminent exanthemata, typhoid, and exacerbations of other constitutional diseases.
6. Status lymphaticus and status thymicus.
7. Mental instability.
8. Delirium tremors.
9. Diabetes.
10. Acidosis.
11. Cystitis.

Of this group, the number that may be prevented from developing or greatly lessened in severity is astonishing. Nearly all may be anticipated by the aid of thorough diagnosis. Urgency may occasionally force operative procedure before removal of the hidden menace is possible, but it is seldom necessary to omit at least a working diagnosis.

The blood picture will enable one to prepare a hemophiliac for operation. Calcium chloride intravenously, hemoplastin, etc., will ordinarily bring the clotting time down to a safe risk, unless due to long-standing blood dyscrasia.

The history will acquaint us with the possibility of mental unrest and delirium tremens, a disease not so extinct as the law demands. The laboratory findings will inform us when nephritic disturbances, diabetes, acidosis, and cystitis are present, and preventive measures can be instituted. The physical examination should reveal any respiratory lesion, however slight, and should inform the examiner of the condition of the heart and circulation; should apprize him of abnormal blood pressure, endocrine disturbance, unstable nervous system, and constitutional diseases in general. It is not the author's intent to repeat methods of determining and treating the many pre-operative complications with which all are familiar. The subject is broad and unwieldly and can be

treated but superficially, leaving more detailed observation to later effort.

It must be emphasized that even slight bronchial affections and prolonged etherization are incompatible, and gas-oxygen or local anesthesia should then be preferred. Serious kidney disease, diabetes, and status lymphaticus strongly contra-indicate operation, except in dire emergencies, until preparatory remedial measures are effective.

The pre-operative stage should be an impartial trial as to the ability of a candidate to accept the indicated treatment. In the absence of symptoms of serious unfitness, prompt preliminary treatment can be instituted and minor conditions removed or ameliorated. The more serious post-operative sequelæ may be prevented by precaution in the pre-operative stage. A painstaking clinical diagnosis, supported by history, laboratory, *x*-ray, and physical examinations, will assure the patient of the best possible beginning of an undertaking not entirely free of hazard.

The victims of lymphatism and status thymicus are very prone to infection and the danger of sudden death during anesthesia precludes the use of any respiratory anesthetic.

Exanthematous disease may develop during the hospital period and particularly in children; and careful inquiry into the general health of the neighborhood and repeated inspection of the skin, mouth, fauces, etc., in the presence of an otherwise unexplainable rise in temperature may reduce post-operative danger. Within the last year, and strange to say among children from rural districts, there have developed cases of smallpox, scarlatina, measles, diphtheria, and chickenpox during the few days following operation for acute appendicitis with abscess. In another child with a foreign body in the urinary bladder, scarlet fever developed on the third post-operative day.

With a view toward anticipating anesthetic or post-operative accidents, careful regard should be given to the physical condition and past history. Alcoholism, obesity, renal insufficiency, and focal infection of teeth, sinus, or tonsil may be disturbing factors and should be given careful pre-operative attention.

Traumatic neurosis, ranging from mild hallucinations to acute mania, may develop in the mentally unstable, and when acute surgery during pregnancy is imperative, the danger of temporary mental unrest should be kept in mind, and especial attention given to the urinary picture and kidney function.

Diabetes, when present, positively contra-indicates operation except in emergencies. Failure to recognize and treat diabetes before interference will probably result in a serious infection, gangrene, or diabetic coma. Karewski reports a 20 per cent mortality in 136 such cases, 78 per cent of which died in coma.

PREOPERATIVE ACIDOSIS

There is a certain danger in routine in the laboratory, as well as at the operating-table. Urinalysis is so common and so predominately negative of danger-signs that failure to recognize a mild physiological disturbance may be excused. In the case of a patient with a history of slight dyspnea on exertion, persistent headaches, or dizziness accompanied at times by nausea or vomiting, extreme nervousness or slightly sweetish breath, it is wise to warn the laboratory technician to look carefully for acetone bodies in the urine, and sufficient time must be taken for the correction of the condition. General anesthesia intensifies acid intoxication, and, when such a reaction is anticipated, should be replaced by nerve blocking or local infiltration. Acidosis will be again referred to in the consideration of the post-operative stage, but its great importance as a pre-operative danger is not to be ignored. Its real treatment, as is true of most post-operative complications, lies in

preventing its development, and only the surgeon who, through his own neglect or failure to recognize it in time, has been forced later to see all efforts to overcome it prove futile, can appreciate the value of pre-operative precaution.

LOCAL PREPARATION

Preservation of the normal integrity of the field of operation will prevent post-operative blistering, dermatitis, and possibly infection. Strong macerating antiseptics are antiquated. A good bath, careful shaving, and sterile binder will meet all ordinary requirements for the day preceding. One thorough application of 3 per cent iodine solution, with sufficient time to bronze the skin before careful removal by alcohol sponge, or a double application of 5 per cent picric acid solution in alcohol, is equally effective. The simplest preparation, if thorough, is the best.

In the absence of specific urinary findings, avoid pre-operative catherization. The presence of prostatic obstruction, residual content, or urethral stricture should be noted and given the very serious consideration it deserves, even to the point of delaying the operation for sufficient correction to assure safety.

The mental state of the patient is seldom given fair heed. A very few moments of cheerful conversation will clear the atmosphere for the long ride to the operating-room. Perfect quiet in the operating suite, carefully screened operative paraphernalia, and an anesthetist who possesses the great gift of inspiring confidence, will soften mental impressions that are to determine the success of the anesthesia.

A well-padded table with a pillow under the knees and lumbar curve, arms comfortably at the side after relaxation, will diminish post-operative discomfort. Intense backache on the first day or two is often the predominant complaint. Except in low abdominal and pelvic manipulation it can be materially prevented on the operating-table.

Conjunctival ether burn is a discredit to the anesthetist. A drop of pure warm castor oil or olive oil in each eye before and after anesthesia and careful application of the mask will prevent. Although seldom necessary a tongue forceps, humane in type, should be at hand. Rude and constant application of jaw pressure is conducive to considerable discomfort. Avoidance of strained, unnatural position of the head and neck is a wise precaution, for the cervical, as well as the lumbar, ligaments can be strained during relaxation.

Permitting periods of partial return to consciousness with the consequent struggling, vomiting, and inspiration of infective material, is often a prime factor in future respiratory complications.

Violent purging within thirty-six hours of operation will insure a distended injected intestinal tract, and greatly increase the likelihood of severe gas pain and atony. The preliminary laxative should be non-irritating and effective and, when possible, should be given forty-eight to thirty-six hours before operation. This may be followed by enemas on the night before and the morning of operation, with fair assurance that the viscera are not unduly irritable.

Urine.—More than one urinalysis should be obtained if possible. Especially important is the one on the day preceding operation. A patient may enter the hospital several days ahead and present a normal urinary picture; if purged and starved of carbohydrates and proteids and dehydrated, the probability of incipient acidosis is not remote. The bladder should be emptied by catheter, only if imperative, just before leaving for the operating-room.

Diets.—Bland, nourishing mixed carbohydrate and proteid diet should continue up to within twenty-four hours. During the last day and night preceding, liquid diet and fluids in great abundance, should be given. This includes also glucose and sodium bicarbonate referred to above.

For the prevention of shock, retention of body heat in the operation-room and afterward is necessary. The operating-table should be thickly padded and all unexposed parts covered with several thicknesses of woolen blankets. Susceptible pressure points are to be protected by cushions. It is confusing to attempt to justify a palsy remote from the operative field.

OPERATION

Difficult indeed would be an attempt to amplify the many and various features of an operation that are reflected for good or evil in the post-operative phase. Time permits only a general discussion of the more important errors or precautions which determine a stormy or peaceful convalesence, and only those which may appear as vitally important will be considered at any length. It is somewhat unfortunate when a surgeon is so busy that he can give to each patient only the time required to perform the operation. He should at least be fully informed as to the pre-operative status of each patient. Even in the routine of well-conducted clinics the personal element should not be ignored. It is confusing, in the course of an operation, on the discovery of unheralded pathology, for the surgeon to call for a hasty review of the history and laboratory findings, realizing all the time that the individual who has entrusted a life into his hands is merely a casual acquaintance. One should afford all the time needed for, at least, a careful review of the assembled information obtained in each case and for a speaking acquaintance, sufficient to retain a distinct clinical vision of the individual, for future association with the pathological picture.

It is not intended herein to dwell in particular upon any of the operating-room details, except in so far as acts of commission or omission affect the end-result.

While it is difficult to dispel in the patient's mind the anticipated horrors of the operating-room, a little

tact and common sense will aid materially in softening the mental impressions and reducing the psychic shock. The operating-room is not a funeral parlor, nor are the attendants in white moving about silently to impress one as ghosts. The long ride through corridors and elevators to the hall of torture, serious faces, the rattle of instruments, and a tactless anesthetist form a combination of genuine mental hazards that sink deeply into an already depressed mentality and materially increase shock. When the pre-operative hypodermic is omitted, it would be better for the patient to walk to the elevator or operating-room in company with a cheerful companion.

ANESTHETICS

The anesthetist, who, if properly equipped for this most important function, should have previously become acquainted with the patient, with smiles and a few cheerful words, irrelative to the impending trial, can quickly direct the line of thought into peaceful channels and obtain rapid physical relaxation. The worth of a capable anesthetist is immeasurable. A rare talent is required to secure even safe unconsciousness and carry all types of individuals through the vicissitudes of surgical endeavor.

The type of the anesthetic must depend upon several factors. Excepting under conditions that directly contra-indicate a certain type, it is wiser to use the one for which the anesthetist has been thoroughly trained. The reason why ether should not be used in the presence of chest complications is obvious; chloroform in heart disease or either of them in liver and kidney deficiencies invites trouble. Crile and others have long since taught us the value of nerve-blocking and the ease and safety with which gas-oxygen anesthesia is administered with a low percentage of unpleasant sequlæ. This is true when administered by one trained in its use. Nitrous oxide is dangerous if administered by a novice. Local anesthesia now fills a long-felt want. Virtually devoid of

danger, it is applicable in an ever-increasing field, and promises in time to largely supplant respiratory anesthesia. Combined with gas-oxygen analgesia it furnishes a most satisfactory and safe operating agent. In operations where all the vital forces must be conserved, local infiltration or nerve-blocking properly placed and given sufficient time, aided by gas-oxygen analgesia, which breaks the current of psychic irritation, will be attended by minimum shock and few post-operative complications.

A relatively small proportion of operators are masters of local anesthesia, and much of the criticism directed toward it should be reflected to the critic and credited to his faulty technic. One cannot too firmly emphasize the advice that in the ordinary uncomplicated case and the absence of strong contraindications, the anesthetic to be preferred is the one of which the anesthetist is master.

In reviewing the various procedures which have a direct bearing upon the subject under consideration, one thinks first of those things which, while seemingly insignificant, are at the same time preventable. For instance, a properly placed generous incision exposing the area to be surveyed will—

1. Lessen the likelihood of overlooking pathology.

2. Permit of a thorough exploration.

3. Make unnecessary rough handling, stretching of sympathetic nerve bundles and trauma of visceral structures.

Persistent and violent retraction are potential agents of shock, adynamic obstruction, thrombophlebitis, and a slow convalescence. Timidity and conservatism, especially in abdominal exposure, are ill-advised precautions. If located anatomically, the length of an incision should be governed by the operative requirements and not by cosmetic ambitions. Keep in mind the fact that unnecessary exposure of abdominal contents is obviated by the protective technic of the operator.

Briefly, the operative incidents which most generously contribute to shock, the majority of which are preventable, are as follows: prolonged anesthesia; the small or misplaced incision which makes necessary forcible retraction and severe tension on the mesenteric root, gall-ducts, abdominal veins, etc; uncalled for rough handling of tissues, viscera, and nerve trunks; long-continued insult to the mesenteric nerve filaments and blood vessels; packing off the operating field with gauze, against the current of incomplete anesthesia; harsh drains that are painful to remove; careless soiling of sterile tissues; excessive loss of body heat; and hemorrhage. A review of this group will convince one that careful technic can accomplish much to eliminate these progenitors of our post-operative difficulties, shock, hemorrhage, acidosis, infection, thrombophlebitis, obstruction, etc.

Time will not permit one to go into technical details with which all are familiar, but emphasis must again be made of the need of more thorough examination and diagnosis; more careful preparation of the patient; and closer attention to the minor details of operative technic as the most sure method of preventing post-operative complications. Among the most serious post-operative complications the following deserve consideration:

Shock.
Hemorrhage.
Acidosis.
Lung affections.
Thrombophlebitis.
Embolism.
Infection.
Ineffectual drainage.
Acute dilatation of stomach.
Heart affections.
Intestinal obstruction.
Psycoses and diabetic coma.

Those which threaten life early are—

Respiratory failure.

Heart failure.

Shock.

Collapse.

Hemorrhage.

Those which may be expected later are—

Acute dilatation of the stomach.

Acidosis.

Thrombophlebitis.

Embolism.

Infection.

Intestinal obstruction.

Pneumonia.

Anuria.

Hiccough.

Diabetes.

Coma.

Delirium tremors.

Psycoses.

Unusual complications to be kept in mind are—

a. Tetanus.

b. Parotitis.

c. Gas bacilli infection.

d. Skin eruptions, mention of which will suffice.

With but few exceptions, this list represents many factors that may be inimical to life. In the discussion of preparatory precaution, one must emphasize the value of prevention. By anticipating their development and removing their cause, much suffering and much danger can be assuaged, or the individual may be fortified against serious progress of the complication.

The primary danger as the patient leaves the operating-room lies in respiratory or heart failure, syncope, or collapse.

The mouth and face should be gently sponged free of collected mucus as soon as the mask is removed, and the head arranged in a comfortable and safe position. Transfer from table to the cart is to be accomplished gently and without abrupt change of position. The anesthetist and a trained nurse or intern accompany the patient to the room, when an equally gentle transfer to a pre-warmed bed is made.

In spite of the fact that pitiful examples of hot-water burns are common knowledge, thoughtlessness superinduced by excitement incident to a serious turn, will end in leisurely repentance. Ordinarily, the bags may be removed as the patient enters, but retention of body heat is of such vital importance in impending shock that to neglect the details necessary to assure it, is gross incompetence. Syncope is prevented by temporary lowering of the head.

A well-trained nurse, who is able to prevent asphyxiation and recognize danger-signs, remains at the bedside until consciousness has returned. The first post-operative hour is zero hour for the sufferer, and a self-reliant nurse who cannot be stampeded is invaluable. When operative trauma has been unusually severe and shock is feared, an enema of four ounces of black coffee and two ounces of whiskey retained per rectum, proves efficacious. It is a sufficiently diffusable stimulant and bridges the gap until vital forces are relieved of their lethargy and reassume their function.

Then follows the replacement of fluids lost at operation. Ordinarily Murphy's admirable method of rectal drip will suffice. Sixty grams of sodium bicarbonate to the liter of 2 per cent to 5 per cent glucose in tap water makes an acceptable proctoclytic medium, furnishing nourishment and fluid when most needed. If more rapid hydration is indicated, distilled water as an axillary seep by hypodermoclysis or intravenously is used. Saline solution should be used with caution.

The first symptoms of returning consciousness are dull, indefinite pain and nausea. Ether anesthesia virtually replaces the former by several hours of stupor, but increases nausea and vomiting when reflexes are again active. While pain never kills, it may be a contributing factor by increasing shock, restlessness, and consequently post-operative hemorrhage. Effective control of severe pain for the first thirty-six hours is justifiable when no contra-indication exists, and the agent by which it is accomplished is a most valuable asset in the amelioration of shock and hemorrhage. A full dose of morphine, when indicated, will conserve the vitality that is ordinarily lost during the first post-operative night of pain, restlessness and mental fear. Repetition of the sedative is seldom needed if the first post-operative night has been robbed of its torture. Thirst may be relieved by the various methods of hydration mentioned above. If all fluids by mouth are withheld until the primary period of nausea has vanished, ordinarily four to six hours, hot water may be administered in small frequent doses, gradually increased and graduated to cool and cold as favorably accepted. If the patient is told that ice and water by mouth too early will cause violent vomiting and pain, and is assured that he is receiving fluids continually he will cheerfully forego the anticipated pleasure in the fear of the penalty, until the period of nausea has passed.

NAUSEA AND VOMITING

Most abdominal operations conducted under ether or chloroform anesthesia, and rarely gas oxygen and local anesthesia, are followed by varying stages of nausea and vomiting.

During the first twenty-four to thirty-six hours a moderate amount will occasion no alarm, and are natural after affects of the anesthetic and operative trauma. The severity and persistence will be measured by the kind and amount of anesthetic employed and the degree of operative trauma, especially in gas-

tro-intestinal invasion. Pre-operative dehydration, protracted starving, failure to secure intestinal elimination far enough ahead of the operative hour, are apt to result in nausea and vomiting. The intestines should be gently at rest and not sensitive or hyperactive from too recent an irritation. Castor oil when purgation is desired, thirty-six to forty-eight hours before operation, followed by a bland paraffine oil and a pre-operative enema, with strict regulation of diet that avoids all irritating and gas-forming foods in the interval, has given pleasing results.

An anesthetist who can obtain an even, steady unconsciousness without intervals of partial return, on a minimum amount of anesthetic, and who avoids unnecessary trauma to the respiratory tract,—tongue, jaws, and pharynx,—will greatly lessen post-operative difficulties. Nausea and vomiting are greatly encouraged by rough handling of the viscera, prolonged tension on the mesentery, and in stomach and gall-tract manipulations. Vomiting that persists beyond a reasonable period, or that recurs after a period of quiet, may be due to sepsis, acidosis, acute dilatation of the stomach, renal complications, adynamic or mechanical obstruction, the pressure of improperly placed drains, dehydration or, as is too often the case, ill-advised attempts to enforce premature resumption of stomach and intestinal function. Drugs by mouth are not well borne within the first forty-eight hours. Loss of fluids should be met, first, by generous intake before operation, up to within two hours, and by some satisfactory method of supply begun immediately following, such as proctoclysis of glucose, 5 per cent, and soda bicarbonate, 2 per cent, in water, continued every alternating two hours for the first twelve hours. Axillary seep and other forms of hypodermoclysis of pure distilled water, as suggested by Bartlett and McKittrick, are to be given, or the same fluid intravenously, if there be need for haste in the wake of severe loss during the operation. Under ordinary circumstances it has been found satisfactory to with-

hold all water, or ice by mouth, as long as nausea is in evidence. Hot water is then begun in teaspoonful doses every few moments, gradually increased to a glassful, followed by cool water. If nausea returns, huge draughts of hot water, containing one drachm of soda bicarbonate to the half pint are given and the stomach emptied. If vomiting still persists, gastric lavage follows, repeated as indicated and systematic search begun for remote causes. We have seldom been forced to resort to heroic measures or to drugs when the above plan has been carefully observed by nurse and intern.

HEMORRHAGE

As a post-operative complication, hemorrhage rapidly menaces life and, quickly eclipsing the other sequelæ, becomes at once the paramount consideration. The term primary hemorrhage is meant to define that which occurs from (1) hemophilia, jaundice, or kindred blood dyscrasia, (2) uncontrolled oozing or an unligated vessel that has escaped the eye of the operator, (3) displaced ligature or removal of clot and ligature during violent vomiting, etc. Secondary hemorrhage refers to that occurring two or more days following operation, and results usually from necrosis of ligature or vessel in the presence of infection.

Primary post-operative hemorrhage is usually a discredit to the surgeon. Its control is to be based first upon observation of all pre-operative precautions and when it does develop by early recognition and immediate action.

Leukemia, anemia, purpura, jaundice, and hemophilia are easily detectable, and those affected must be subjected to operation only when mandatory. In emergencies, when necessity demands interferences as a life-saving measure, local pressure, transfusion of human-blood serum properly grouped, thromboplastin, hemoplastin, calcium chloride, and gelatin

are of value. The defibrinated blood of a near relative has a most salutory effect.

One should carefully inspect the entire operative field after a period of relaxation, immediately preceding closure, and no bleeding point, however modest should go unchallenged. Square knots, applied snugly, isolation and individual ligature of important vessels, and avoidance of mass ligation when intra-abdominal tension may disrupt are all precautions which may now and then save our pride and self-assurance.

Hematomas of mesentery, intestine, broad ligament, etc., must be incised, evacuated, and the bleeding points arrested. One should never rely upon luck to control a hidden hemorrhage. The important part of a post-operative hemorrhage is to first recognize it and then lose no time in controlling it. Hemorrhage and shock are clinically so closely allied that they are often confused. Both can kill, and, while clinically they may resemble each other, they do not respond to the same primary treatment, and therein lies the value of early classification. Symptoms of a concealed hemorrhage are—

1. Restlessness or alertness out of proportion.

2. Rapidly increasing pulse rate and decreasing blood pressure.

3. Mounting leucocyte count.

4. Insistent thirst and air-hunger, merging rapidly into a state of deep shock.

Hemorrhage develops an acute anemia in proportion to the rapidity of the loss; intense thirst and air hunger are late and not early symptoms and are grave indications. If mistaken for surgical shock and anti-shock measures applied, the hemorrhage will be increased. All blood-pressure raising treatment is directly antagonistic and will result fatally if persisted in. Morphine is the only drug indicated. Head-low position to assure continued function of the med-

ullary centers and the quickest shock-free method of stopping the leak mechanically are to be applied without hesitancy. Then one can immediately institute anti-shock treatment, elevation of blood pressure, and resplenishing the blood-stream, with the welcome assurance that ground is being gained. There is no more severe tax upon the surgeon than when called upon to recognize and deal with a post-operative hemorrhage complicated by severe shock; and no occurrence can so indelibly impress him with the inestimable value of attending to every preparatory and operative detail that will make post-operative hemorrhage unlikely. It is a well-known fact that recovery may, and often does, follow a very severe spontaneous hemorrhage, as in ruptured ectopic; lowered blood pressure and clotting time will usually check the flow, but post-operative hemorrhage, with the patient in a state of greatly lowered vitality and a large amount of residual blood in the abdominal veins, leaves a narrow safety margin before the vital nerve centers become anemic and cease to functionate. Blood-donors should be available in every severe case.

POST-OPERATIVE ACIDOSIS

The factors which produce acid intoxication are not as yet clearly defined. Although recognized as an entity early in the history of general anesthesia, it was first believed to be "late chloroform poisoning." Peters, in 1857, first detected acetone in a diabetic patient. For sometime he and others considered it possible only in diabetes until Beck,[5] in 1894, conducted a series of pre-operative and post-operative examinations in 1,500 non-diabetic patients and, in over 60 per cent found a pathological amount of acetone present. Numerous investigators by physiological chemistry and experimental surgery proved that it is a form of acid poisoning, which frequently follows anesthesia, but incident to anesthesia only because of the fact that it promotes disarrangement of fat or carbohydrate metabolism. A mild degree

of acetonuria may be found without clinical symptoms being present. Wilber[26] and Marriott[25] observed very severe attacks of acid intoxication with only a slight degree of acetonuria present. Crile, after exhaustive experimental and clinical study, is of the opinion that, aside from general anesthesia and operation, acidosis may follow auto-intoxication, exertion, emotion, Graves' disease, etc. He states that "The brain, adrenals, liver, thyroid, and muscles together play important parts in energy transformation and that at least three of these organs,—the brain, adrenals, and liver,—are especially concerned, also in the neutralization of the acids resulting from energy and transformation."

It is well known that all inhalation anesthetics increase the acidity of the blood. According to Gelhorn, acidosis appears in a high percentage of local and spinal anesthesias. It is present in diabetes and may be anticipated in malnutrition, starvation, especially as regards proteids and carbohydrate, in dehydration, and in the presence of all metabolic derangements.

J. A. Kelly,[9] *Annals of Surgery,* February, 1905, reported 46 cases of acidosis with 6 deaths. The conditions for which these patients were admitted are of sufficient interest to repeat, and they prove the versatility of the disease. Contusions and fractures, 14 cases; appendicitis, 11; severe lacerated wounds, 3; cerebral concussion, 2; localized septic processes, 2; gastric disease, 2; carcinoma, 2; salpingitis, osteomylitis, cervical adenitis, floating kidney, diabetic gangrene, hemorrhoids, fecal fistula, epilepsy, alcoholism, burns, and typhoid, each 1 case; 17 developed without anesthesia having been administered. In the aged, as well as the young, acidosis may develop with startling rapidity and, unless energetically treated, pass quickly beyond our control. No other postoperative complication, except hemorrhage and shock, can so quickly sweep aside all barriers and progress to a fatal issue.

Symptoms usually appear from one to five days following operation or injury. The depth of the intoxication will determine the rapidity of its development. A mild sweetish breath may first attract attention. The patient may become apathetic, and the pulse and temperature may vary but little in the early stages. Later a sharp rise or sudden fall below normal with rapid pulse change will point to a profound toxemia.

Nausea and vomiting after the normal period has passed should warn. Air-hunger, sighing respiration, periods of uneasiness or excitation followed by stupor, intense thirst, headache, and the presence of acetone and diacetic acid in the urine form a convincing group of symptoms, any one of which should stimulate the attendant to immediate investigation.

TREATMENT.—This is the one really serious post-operative complication that can usually be prevented from developing. Knowledge of the causes which are known to be contributory make one more or less master of the situation. Prevent pre-operative starvation and dehydration; efficient elimination without exhaustion; and examine carefully each highly acid urine for acetone bodies. Bicarbonate of soda and glucose solution are to be given freely for as many days before operation as the condition will warrant; push alkaline fluids up to within two hours of operation. In suspicious cases select the type of anesthetic least prone to produce acidosis (gas-oxygen and local), inflict the least possible operative trauma, and, working with consistent rapidity, avoid prolonged anesthesia.

If the case in hand is so urgent that the above precautions are impractical, intravenous glucose and sodium-bicarbonate infusion immediately preceding ordinary anesthesia, are advisable. Continue the preventive measures after operations. Intravenous, 5 per cent glucose and soda, or proctoclysis continued liberally for twenty-four to thirty-six hours will often

rehabilitate an unstable metabolism. Thus will soon be replaced the lost body fluids. The period of post-operative starving may be safely shortened by replacing the proteids and carbohydrate as early as feasible. Ordinarily it is believed that protection is relatively assured by continuous proctoclysis of 2 per cent sodium bicarbonate and glucose solution in tap water reinforced by alkalinized fluid by mouth as early as accepted. Tap water in abundance is essential to promote elimination, the soda restores the alkaline balance, and glycogen in the liver cells is replaced by the use of glucose. Morphine to its physiological effect is the one drug indicated.

When acid intoxication has really developed the necessity for rapid replacement of body fluids, well alkalinized, is obvious, and the heroic measures mentioned above must be put into effect without delay. If diarrhea follows the excessive use of sodium bicarbonate, sodium citrate may be safely substituted, and such stimulants as are indicated may be used to discourage dissolution until the metabolic balance is recovered. Acidosis is sometimes mistaken for shock. It may accompany shock. It is likely to develop after a severe hemorrhage and may be present to confuse the diagnosis in post-operative hemorrhage. It is evident that, in the presence of active post-operative hemorrhage, but little improvement in accompanying acidosis or shock may be hoped for until the hemorrhage is controlled. Acidosis is so respectfully feared by all surgeons that anti-acidosis routine in one's work should be favorably contemplated; make its occurrence unlikely by pre-operative preparation, selective anesthesia, rapid, finished, and careful surgery, and, in the early post-operative stage, reestablish the body fluids and the depleted alkaline and carbohydrate elements in the blood and tissues.

SHOCK

Shock was recognized nearly four hundred years ago by William Clowes, but Little, in 1795, first ap-

plied the name to the condition as we now recognize it. Galz, in 1870, by frequent experimentation called attention to the vasomotor changes which followed trauma and irritation. Nuzure ("Ochsner," Vol. 1) defines shock as "a general bodily state following various surgical operations and wounds, characterized by a persistent low arterial blood pressure, rapid, thready pulse, pallor, sweating and shallow, rapid respiration." As in severe hemorrhage, there is an insufficient circulation of blood, and the resulting anemia is no doubt a factor in vital cell destruction which accompanies the severe long-continued or fatal form. Most authorities now agree that the etiology may not be attributed to one single cause, but to a variety of causes. During the recent war Porter's "Shock at the Front" called attention to lipemia as a persistent cause of shock in war wounds. The author has witnessed several fatal cases of death by fat embolism, in which symptoms were in true alignment with intense shock, yet failing to respond to heroic treatment. Bissell (*Surgery, Gyneology and Obstetrics*, page 17, xxv), basing his opinion on animal experiments, refuted the theory of fat embolism as a caustive factor in shock. Numerous and variable theories as to the cause of shock have not been wanting. Psychic stimuli, prolonged or severe irritation of peripheral nerves, vasomotor paralysis and exhaustion, carbon-dioxide deficiency in the blood, and cardiac failure are only part of the past or present theories that mark persistent efforts to clarify this confusing affection. Crile, Seelig, Henderson, Lyon, Meltzer, and many other earnest scientists deserve liberal credit for their exhaustive studies, but the efforts of none have been as yet rewarded with unqualified approval. Until the scientific atmosphere is clear, and an unassailable theory of the causes and physiologic phenomena is proven, we must be content with the practical knowledge we now possess. It cannot be denied that shock develops during and following operative manipulations and anesthesia, and that loss of blood and extensive or long-continued

irritation of nerve trunks, and severe traumas, such as crushing injuries, produce shock to a profound degree. We know that during the state of shock the heart and vasomotor agencies are grossly disturbed, that organic functions are inhibited, and that psychic disturbances may be marked. Certain histologic changes in the central nerve cells occur in shock. Sajous describes the process as primarily a central disorder, which results in vasomotor incompetency and consequent reduction of blood pressure. The cerebral and peripheral vessels are depleted, and the larger abdominal vessels engorged. By reduction of blood supply the adrenals become inadequate, and blood pressure is further influenced. It is not the function of this paper to determine whether any or all of these are related to cause or effect. Experience has taught us that certain conditions produce shock and that we may prevent its appearance or lessen its severity and danger by observing a certain degree of precaution in our surgical work.

SYMPTOMS

Shock may vary in intensity, from a mild depression to a complete dissolution of the vital forces. In mild shock there is usually a moderate fall in blood pressure, and mentality becomes dull and apathetic. General weakness is apparent, and pupils dilate and react slowly to light. The skin becomes pale, cool, and moist, and the pulse weak and rapid and diminished in volume. Thirst, due to free perspiration, is frequent. As shock increases, the temperature and blood pressure drop below normal, the facial expression becomes listless, the eyes staring and the pupils greatly dilated, respiration shallow and difficult, and there is often loss of consciousness; sphincters cease to functionate; hiccough and vomiting may occur. Syncope, heart failure, and death may follow.

PREVENTIVE MEASURES

Pre-operative: Determine quality and quantity of kidney function, for kidney disease favors shock.

Any deficiency in metabolism should be corrected; avoid excessive purging and dehydration. Determine by most careful history and physical examination the presence of any inherent weakness or pathology that may be of influence. Allay all fear, promote confidence, and eliminate all environment that arouses antagonism in the patient. Mental relaxation, confidence in the surgeon, quiet in the operating-room, a capable anesthetist, and body warmth—all contribute toward minimum shock. Preliminary hydration with soda and glucose has been emphasized elsewhere and will but be mentioned here.

SHOCK

TREATMENT (post-operative).—The outstanding features of acute surgical shock are—

1. Cerebral anemia.
2. Vasomotor instability.
3. Lowered blood pressure.

Most of the clinical symptoms result from one or more of this triumvirate. The small volume of blood continued in circulation is unable to secure sufficient interchange of oxygen and carbon dioxide, and hence the respiratory difficulties and acapnia.

Mental lethargy, heart failure, and diminished function of all vital organs are all enhanced hourly as cerebral anemia remains. The indications, therefore, in the treatment of shock are to reestablish the brain circulation by position and mechanical pressure exerted on the extremities and abdomen. At the same time fluids by mouth, proctoclysis, hypodermoclysis, axillary seep, transfusion, etc., and judicious application of external heat with effective morphinization, furnish the basis of treatment. This differs from the treatment of shock following hemorrhage in that the bleeding must first be controlled. It must be remembered that in true shock not superinduced by severe hemorrhage, the normal volume of blood is still resident within the vessels, and the danger of over-

loading a greatly handicapped heart with fluid, before elimination by skin and kidneys is again active and able to maintain the normal balance, may result in heart complications of serious magnitude. Distilled water, tap water, physiological saline, glucose solution, and blood are all used to complete hydration. Infusion of solution of gum acacia is mentioned only to be condemned as a routine. The most encouraging effects are witnessed when properly grouped blood by transfusion direct, by aid of the Percy modification of the Kimpton tube, or by the citrate method, is given.

The body heat must be restored, and the means at hand must provide the method. Hot bottles, blankets, and hot air are efficacious. Hot-water burns are as easily inflicted during deep shock as during anesthesia and must be guarded against. The electric shock bed in which the amount of heat supplied can be regulated, is a genuine hospital necessity. Fortunately, most cases of severe shock occur in hospitals. The great value of complete physiological rest and external heat in shock following severe war wounds was exemplified in the field hospitals. Many cases in which the wounded, as brought from the field stations, seemed almost lifeless, who could not have withstood even anoci-association exploration, were morphinized and placed in crude hot-air shock beds, and the reaction often witnessed was as startling as it was welcome.

Temporary stimulation by camphor in oil, strychnia, etc., is unworthy of great dependence and at times not devoid of harm. One may now and then observe, in the stress of excitement, the repeated injection of temporary stimulants into subcutaneous areas that are bathed in a halted lymph current with but little hope of entry into the blood-stream. Later on, when the circulation is reestablished, the previously injected stimulants are swept into the current, and a lagging heat may be whipped to the danger point, if not beyond it.

SHOCK SUMMARY

The control of shock lies primarily in the observation of preventive measures. Haste in preparation which omits a single detail that may count for additional safety is to be deplored. Transfusion of blood, not once but several times, may be an essential preoperative duty, especially if a wasting disease or a depleting hemorrhage has preceded it.

It is unwise to send a patient chilled with fright to a cold operating-room and table when hot blankets are easily obtainable.

One should carefully select anesthetist and anesthetic; all unnecessary surgical manipulations, especially rude handling of the splanchnic areas, rough traction, or prolonged exposure of the viscera to a reduced temperature, are among avoidable errors that will surely promote shock.

Replenishing the body fluids and heat as soon after operation as consistent, avoidance of spasmodic stimulants, careful nursing, and rapid correction of the signs of impairment of the vasomotor mechanism and its consequent drop in blood pressure, are worthy factors in the humane scheme of prevention. Lastly, morphine to block irritating stimuli to exhausted cerebral centers and to promote the recuperative power of rest, completes a well-tested routine in severe surgical shock.

THROMBOPHLEBITIS

There are four factors, according to Frazier (Keen's Surgery, vol. 1, P. 418), which play an important part in the formation of thrombi:

1. The presence of infective organisms.
2. Structural alterations of the intima.
3. Disturbances of the blood current.
4. Chemical changes in the blood.

The latter three are more or less contributory and are not as essential as infection in the pathogenesis. In surgery the process may begin as a phlebitis. Trauma, such as strong retraction, may produce roughening of the intima. Changes in the blood current and pressure following operation may slow the stream at that point and small thrombi may form. Many operations, especially for appendicitis, pelvic lesions, and those involving the mesentery, are prone to result in thrombi and emboli. There is little doubt but that many post-operative cases often suffer numerous small emboli without being recognized as such.

It is possibly true that so-called post-operative pneumonia cases are embolic in origin.

Clark furnishes convincing proof that infection is not a necessary factor. He believed the contused vessels, such as the deep epigastric, become the seat of a thrombus, which develops downward and, in a limited number of cases, enters the deep femoral, and becomes lodged there. Left-sided involvement is most common, probably because of the circulatory arterial constriction, partly occluding the iliac veins and slowing the current. It is a brief and hasty step from this site to the right heart, and no complication can strike quicker nor more fatally than can the detached embolus. Entering the post-operative phase, unwelcome and without warning, it strikes terror to surgeon and patient alike, and both are helpless in the extreme. Small emboli from the origin of the appendix stump are frequent, and no remedy for their cure is known to science. The only hope lies in observing all known principles of prevention, such as early post-operative activity, correction of circulatory disturbances, and by assuring free drainage of all infective areas, watching carefully meanwhile for signs of phlebitis in any locality. The left femoral near the deep epigastric tribatory is most often involved; at times the calf of the leg shows the first signs of venous obstruction. Careful attention early in the attack will now and then abort the

attack. Elevation and heat to the diseased limb, no massage, and complete bed rest are the chief factors in treatment of the femoral type of thrombophlebitis.

EMBOLISM

Mesenteric and portal embolism are fraught with danger in the extreme. The symptoms naturally depend upon the size and location of the embolus. Interruption of the portal circulation is rapidly fatal. Mesenteric embolism is ushered in by agonizing pain, symptoms of shock and hemorrhage, extremely rapid pulse, with subnormal temperature and prostration. The involved loop rapidly becomes gangrenous, and, unless death supervenes early, obstruction becomes complete and the temperature rises as the peritoneum is invaded. After subsidence of the initial shock, exploration and temporary ileostomy under local anesthesia are advisable. Emboli which enter the right heart and subsequently the lung are proportionately frequent. Most post-operative pneumonias are probably due to minute emboli, and lung abscess and empyema are not uncommon sequelæ. When a giant thrombus plugs a large division of the pulmonary artery, death is instantaneous. There is no other post-operative complication that can shatter hopes and expectations so abruptly as fatal cerebral or pulmonary embolism. The sudden pallor and shriek of pain from a patient who is about to be discharged as cured, followed by a few moments of conscious agony, cyanosis, respiratory failure, and death, form a picture that is not easily erased from memory. It is incumbent upon us to keep in mind these dire possibilities in every operative case, not to the degree that it is depicted in our faces, but to the extent that most careful observation is accorded every trivial pain localization, every rise in temperature, every "sore" spot complained of by the patient, and to ignore it only when it has been eliminated as a possible menace. I am firmly of the opinion that many patients develop septic thrombi and are discharged from

the hospital without it having been recognized as such. Pain in the leg, during any stage of the post-operative period, should call for complete bed rest, elevation, warmth, and watchful waiting. Fat embolism is not uncommon, and, while seldom fatal, is worthy of strict care in serious comminuted fractures and extensive injury or infection of the soft parts in regions where fat is predominant.

POST-OPERATIVE INFECTION

There is but little excuse for a post-operative infection to remain long undiscovered or ignored. The blood picture and classical symptoms should prevent the delusion often indulged that our technic is infection proof. Pus under pressure in a newly made wound where lymph spaces are patent and an excellent culture medium available may rapidly change the picture of ideal convalescence to a nightmare. It is an error to silence with unfounded assurance and without investigation, the complaint of pain and soreness. The skin and lips may appear normal with co-aptation perfect and yet harbor a cubic centimeter of infective fluid that can so easily retard a recovery. We should not expect the little vascular subcutaneous tissues to defend our negligence. A small sterile probe passed into the wound at the most sensitive point will open a tract that may reestablish the balance in favor of the normal tissue resistance, which, in a few hours, might have been seriously retarded. Deep-seated infections due to imperfect drainage, and those transmitted by blood and lymph stream to the liver, pleura, lung, pancreas, etc., must be recognized early if serious danger is to be averted. The *x*-ray is of inestimable aid, and remedial measures should not be delayed. The secondary infection is often a far more serious factor than the primary operation, and delay in its recognition and attack will only enhance that danger and make more difficult our subsequent effort.

ACUTE DILATATION OF THE STOMACH

Prolonged abdominal operations, especially involving the right upper quadrant, are not infrequently followed by acute dilatation of the stomach, a serious and often fatal menace. Albrecht attributed it to obstruction of the lower duodenum by the superior mesenteric vessel where it crosses the spinal column,—a "gastromesenteric ileus." Others hold atony of the stomach, temporary paralysis of the gastric branch of the vagus, duodenal kink, or pyloric spasm with excessive secretion, to be the cause.

SYMPTOMS

It is often insidious at the onset. The usual post-operative vomiting continues as an over-flow or regurgitation. Thirst is unquenchable, urinary output diminished, pulse rapid, and prostration out of proportion. The epigastrium may or may not be distended.

TREATMENT

Do not await vistule epigastric distention. Persistent vomiting, an increase in pulse rate without corresponding temperature rise shortly after operation, and excessive thirst mean either hemorrhage or acute dilatation of the stomach. The stomach tube cannot harm in hemorrhage when the stomach is not involved, and will usually clear up the diagnosis. Continuous lavage with hot water and the prone position are, as a rule, successful in relieving until the normal tonicity is restored. It is advisable to use the stomach tube freely preceding operations in the upper abdomen, where no contra-indication exists, and its post-operative value is immeasureable. Body fluids must be restored by proctoclysis or infusion. This will restore normal kidney function. When promptly met by this treatment, relief is usually obtained within twenty-four hours. Slow resumption of fluids and food by stomach is necessary. Drugs are without avail and may harm.

INTESTINAL OBSTRUCTION

It would be unwise to enter the usual prolonged discussion of this most serious post-operative complication; only brief reference will be made to the essential phenomena by which it is recognized. Whether the ileus is dynamic or adynamic must be determined before treatment is effected, lest the chance of recovery be lessened. Pain may or may not be present. Abdominal distention with persistent vomiting becoming fecal in type as reverse peristalsis becomes active, rapid dehydration, exhaustion, pinched facies, and deficient urine output mark the progress of unrelieved obstruction. Visible peristalsis is a prominent local feature, and the site of the obstruction can at times be palpated.

Pseudo-ileus or adynamic ileus, a temporary paralysis of sections of the intestine, is present to some degree in most severe laparotomies. It is usually transient and frightens more than it harms. In abdominal operations where much handling of the intestine and mesentery, and prolonged exposure have been necessary, the readjustment may be somewhat retarded. The condition disappears ordinarily during the few days of intestinal quiet. When it persists and one or more sections fail to respond to the sympathetics, all the symptoms of true mechanical obstruction develop. A knowledge of the status within the abdomen may be necessary, and pituitrin may be given with good effect. If true obstruction is ruled out, enemata may also bring relief; and in combination with lavage for vomiting and proctoclysis, with no fluids per os, normal peristalsis is restored.

Operation is contra-indicated, but exploration under local anesthetic should be the rule if differentiation between the two types is so difficult that serious delay is caused.

True post-operative intestinal obstruction presents a kaleideoscopic picture in that the etiology is so vari-

able. Bartlett gives a classification which is simple and comprehensive:

1. A dynamic (functional) ileus:

(a) Paralytic.

(b) Spastic.

(c) Hirschsprung's disease.

(d) Thrombosis and embolism of mesenteric vessels.

2. Mechanical ileus:

(a) Strangulation.

(b) Obstruction.

(c) Volvulus, knots.

(d) Caused by Meckel's diverticulum.

(e) Kinking.

(f) Strictures.

The paralytic form commonly develops in the presence of infection or peritonitis. The spastic in those suffering from disorder of the nerve supply, toxic irritation, and intestinal parasites.

Thrombosis and embolism of mesentric vessels are rare, but dangerous indeed when they occur. In the mechanical form, direct pressure, twists, intussusception, and kinking, promoted by adhesions, are most numerous and fraught with real danger. We are inclined to hesitate too long in our diagnosis in the mechanical form of obstruction. Several abdomens had better be explored and a few errors made than to participate in one death that might have been averted. True ileus with complete obstruction, not due to spasticity or infection, should be subjected to early operation with the aid of local or gas-oxygen anesthesia. It is a grievous error to permit dehydration from persistent vomiting. It is not so important to the patient that we determine whether toxic absorption from the proximal bowels or dehydration and acidosis are the cause of the symptom complex, as it is that the constriction be relieved by the most rapid means and with the least additional shock to

an already overtaxed system. Abdominal pain, hyperactive peristalsis, distention, and vomiting not relieved by repeated lavage and enemata, recommend action before feculent vomiting and shock have arrived. Dehydration must be combated by saline or glucose infusions, freely and frequently. All medication is forbidden, and morphine particularly is contra-indicated. Just as soon as mechanical obstruction is fairly assured, replenishing the alkalinity and body fluids and relief of the obstruction are imperative. Irresolution in the face of such definite indications bespeaks a timidity that ill becomes a surgeon.

It must be again mentioned, in passing, that thoughtful preparation of the patient for operation, careful observation of the intra-abdominal pathology, readjustment of the viscera in closing, and rigid post-operative supervision will make more difficult the development of serious forms of post-operative ileus.

CONCLUSIONS

1. Many post-operative complications may be traced to some preparatory, operative or post-operative neglect.

2. No major operation is so simple or safe that a careful history and physical and laboratory examination are not essential.

3. Routine methods of preparation may lead to serious consequences. Each patient is entitled to a careful inquiry into his individual characteristics.

4. First determine the necessity of operation and next the fitness of the patient to withstand it. One will then avoid surgical over-indulgence and save oneself many regrets.

5. Acidosis.

6. Shock and collapse.

7. Hemorrhage.

8. Acute dilatation of stomach and embolism are the group about which post-operative worries center. It would be well for us to know just how much of the blame for their development may be justly attributed to our own neglect. The most salutory picture of any operation is a satisfying end result. Unselfish attention to the minor details of diagnosis, operation and post-operative care will conserve life.

DISCUSSION

Dr. Jabez N. Jackson, (Kansas City, Mo.): This is the most interesting subject we have to solve to-day. We are familiar with patients the day before operation, and they die altogether too often following operation because of inadequate preliminary preparation.

I have been strongly impressed for a number of years that our surgical mortality had little to do, apparently, with the seriousness of the surgical operation or the character of the surgical work which was done. I am convinced more than ever that we have to meet in surgery the problem of anticipating the vital resistance of the patient and his ability to undergo operation, and, probably, in any operation, no matter what the operation may be, there are certain toxins going to be engendered that the patient has to take care of, and in a large measure this will depend on the patient's capacity to take care of the load thrust upon him. If we are in a position to know whether it is safe for a patient to submit to operation and be in good condition afterward—when we know more about the methods by which we can put a patient in a safe condition, we shall approach greater security.

I have been impressed in the last few years with the one fact that much of our mortality occurs in patients who are operated on too promptly,—in other words, there is no anticipatory treatment, no preliminary preparation for operation like there should be, and patients in the future must have longer periods of preliminary preparation if we would still lower our mortality. When we can determine more or less capacity and function of the liver, for instance, which I think is the most important organ and the least understood, to get rid of toxic products, we shall know whether a patient is going to recover or not. For instance, a patient is brought in at two or three o'clock in the afternoon to be operated on. A blood

examination and urinary examination carefully conducted shows nothing the matter. There is no nephritis. The patient has a perfectly healthy heart and lungs, and yet after operation that patient has an acute abominal distention and, finally, suppression of urine, and dies. That patient ought to have recovered rather than died. In this and other instances surgeons in the past have never thought of determining the capacity of the liver to take care of the toxic load put upon it by operation.

Nowadays, except in emergency cases, patients are more carefully and fully prepared. I make it my business to give instructions that before a patient is operated on for at least a week he has to drink all the water he can; drink a teaspoonful of bicarbonate of soda three or four times a day in a tumblerful of water, and three or four doses of castor oil to clean out the products in the intestinal tract. When the kidneys are clean and the liver filtered we can operate and do almost anything we want, and the patient will recover.

When it comes to anesthetics we have certain damage done to the liver, whether the anesthetic be chloroform, ether, or nitrous oxid, and whenever operation is undertaken the liver cells are given an additional job between the whole digestive tract and general circulatory system, for every particle of blood passes through the liver, one of its functions being detoxication. When the liver cells are blocked, then comes an additional load, and the patient is not able to do his own detoxicating. The products of intoxication get into the general circulation, and we may have an acute gastric dilatation or an acute nephritis and have all the terminal conditions of this, that, or the other. But most of these terminal conditions are fundamentally due to over-intoxication incidental to the operation and to the incapacity of the organs to take care of the toxic products. If we can by anticipatory or preliminary measures prevent this, we shall have done a great thing toward decreasing the mortality and morbidity of surgery.

Dr. Dean D. Lewis (Chicago, Ill.): This is a timely paper. It emphasizes that the surgeon should be a diagnostician, a pathologist, and a therapeutist. The tendency within the last few years has been to develop a mechanical surgeon. The medical man has made the diagnosis and then has invited or directed the surgeon to carry out the line of procedure which he (the medical man) has thought proper. I hope that this tendency

will soon disappear, for the best work can be done only by co-operation of the two.

The surgeon often attributes post-operative complications to rather obscure things. We hear a good deal now and then about hemophilia, but in most instances I believe that hemophilia merely means that the methods which we have of controlling hemorrhage have been poorly or improperly applied. I do not mean, however, to deny the possibility of a genuine hemophilia. Acute dilatation of the stomach is, I believe, in most instances, due to peritonitis or mechanical defects of gastro-enterostomy. In most instances it seems some fault in the technic of an operation occurs as the basis for its development.

Patients may be overprepared for operation. Formerly this was common. Cathartics, which kept the patient awake, were administered at night, and the rest was disturbed by a complicated and extensive preparation, which we now know was useless, if not harmful. The preparation of the patient should be as simple as possible. and the patient should approach the operation in as nearly a normal condition, mentally and physically, as possible. Surgical preparation and after-care should be as simple as possible and reduced to a minimum. If the diagnosis is correct, the surgical technic good and directed only toward the removal or correction of the existing pathological condition, our troubles will be greatly reduced.

Dr. E. S. Judd (Rochester, Minn.): Any one who has done much prostate and bladder work realizes that it is the preparation of the patient that has changed the prohibitive operation to a comparatively safe operation. In these cases we have the most striking instances of the value of preparation of surgical cases before operation. There are, of course, other patients who need to be prepared very carefully before operation is undertaken. Dr. Yates mentioned a group in which the myocardium has been definitely damaged. Patients with so-called thyrotoxic goiters, who also have a definite myocarditis, can be made very much better surgical risks if given digitalis before operation. We all know the value of rest in cases of exophthalmic goiter.

I wish to mention especially some work one of our Fellows is carrying out: It is the careful preparation of jaundiced patients who have disturbed liver function. In our experience they have been poor surgical risks for radical operations. We have tried all sorts of schemes

in the way of transfusion and of the other methods of restoring liver function before, during, and after operation, but up until the past few months we have been able to accomplish almost nothing. The coagulation time of the blood in these cases is oftentimes almost prohibitive, fifteen to twenty minutes; and as a result we all know these patients will start bleeding sometime after operation and bleed from the mucous membranes, as well as from the operative wound, and die in spite of repeated transfusions. The work of Walters consists in the intravenous administration of calcium and the anticipation of the disturbance in renal function in these cases.

Dr. Horatio B. Sweetser, (Minneapolis, Minn.): Preoperative laboratory investigation and treatment has very much reduced the mortality in the dangerous class of cases in which there are retained products of metabolism. This is well exemplified in an experience in our clinic about a month ago with a diabetic patient 67 years old who came in suffering acute urinary retention due to enlarged prostate. His blood sugar was 0.39, and clinically he seemed on the verge of diabetic coma with dry tongue and very obtunded mentality. I am very sure if we had operated on him without preparatory care he would not have survived By pre-operative treatment we reduced his blood sugar to 0.10 per cent, and held it at that point while increasing his diet up to 2,000 calories. We then operated on him with an absolutely perfect result. The wound healed rapidly, and perfectly, and he went home in a few weeks apparently well, physically and mentally.

Dr. W. W. Grant, (Denver, Col.): For years I believe surgeons have given much detailed attention to the preparation of the patient. They put their patients in bed when a serious operation was contemplated; they looked after the bowels and kidneys, and gave some general attention to the condition of the blood; and in a general way they put the patient in a very satisfactory condition for operation.

The tendency to be feared is the dismissal of the patient after he is operated on by a skillful surgeon. He is sent to his room in good condition, and the surgeon too often dismisses himself from further serious responsibility by giving the usual directions to his assistant, to the nurse, or to the intern; consequently, this has led to a good many evils in the after-treatment of important surgical cases. I feel that this is due largely to the fact that in recent years the refinements of technic and cleanliness have been carried to such a degree of perfection that the surgeon

has felt when he has complied with these specific directions in these particulars, his responsibility practically ceases when he has finished the operation, and he has not given his patient that subsequent care and attention which many require of him rather than have it devolve upon some assistant or nurse. This is especially true of the busy surgeon whose hands are full. I feel that the post-operative treatment very frequently, rather than the operation itself, determines the result in many cases. In my opinion some die because they had not received that skillful care and attention in the after-treatment that they received on the operating table, and it is one of the serious faults of our time. We want to get away from the fact that mere technic is the secret of good surgery. It is necessary surgery, but it is also important to look after and regard other things besides technic in the performance of an operation. Surgical judgment should be applied in every case, and it is the hope of every surgeon to know, and his duty to apply individually the accepted rules and principles of surgery demanded in every important operation and in the after-treatment of every such case.

Dr. Miles F. Porter, (Fort Wayne, Ind.): I have often thought that if we could make the average intern, assistant, or nurse forget that a patient has bowels and remember that he has a mouth, we would not have so much post-operative trouble. How often it is we go in the morning to see these patients and find that their bowels have not moved for two or three days. They have a little fever. No thought at all has been given to a dirty mouth, but they are terribly worried about their large bowel which was created for the purpose of acting as a cesspool. I say, let it alone, but cleanse the patient's mouth. The point I want to make is this: In my belief our so-called ether pneumonias do not develop because a patient has inspired a little blood, but it is because that blood was infected when it was aspirated and carried down out of a dirty mouth into the chest cavity, and these germs could have been cleansed out before he went to the operating-table.

I am very much interested and have been for a long time in the prevention of those accidents that occur following operations on jaundiced patients. I now feel more secure by following this plan in a jaundiced case: I do not care to wait very long to get the coagulation time of the blood diminished, for eventually the destructive changes going on in his liver will get worse. You can control hemor rhage by giving him an injection of serum or by transfussion. The important thing for the surgeon to do is to

start drainage of that liver, and my impression is, although it is not based on experience sufficiently adequate to make a dogmatic assertion, that an immediate operation in these jaundiced patients is best and should consist in a simple drainage of the gall-bladder under local anesthesia and coupled, if you please, with transfusion or the injection of serum to counteract the tendency to hemorrhage. This is better and safer surgery than to wait for days while the pathology is increasing and the destruction of liver cells is increasing, and in the meantime giving calcium intravenously or in any other way.

Dr. A. E. Benjamin, (Minneapolis, Minn.): I think we all agree with what has been said with regard to the preparation of patients. The mortality has been reduced a great deal by proper preparation. It has been my plan to put patients in the hospital several days beforehand to study them carefully.

There is one thing that has not been brought out in this discussion, and that is, how to account for the post-operative complications, although a careful technic is carried out in doing abdominal surgery. Why is it that many times we re-operate on patients with recurrent abdominal adhesions and find that the omentum and the intestines are adherent to the whole abdominal scar? What has occurred in those cases following a previous operation? If you go over the histories of them you will find that they had a stormy convalescence, with distention of the stomach and intestines; they vomited and had a great deal of pain; the intra-abdominal tension was increased and adhesions resulted. Why is it that we have these adhesions, and how can we prevent them? Surgery must in some way prevent post-operative adhesions. I think some of the bad results are due to a local peritonitis, as Dr. Lewis has mentioned. They are not all due to gastric distention or to an acute dilatation, but they may be due to a mild infection or to catching the omentum or intestine in sewing up the abdomen. The forceps which you use to hold the peritoneum may inflict wounds in the peritoneum so that adhesions of the intestines occur, or gauze may injure the peritoneum. Personally I like to use a rubber dam, a large sheet of it, instead of gauze. In that way I think I am able to prevent loss of heat, prevent irritation of the bowel and prevent adhesions by always turning the peritoneum outward, not letting any raw surface remain within the abdomen when I close it up and close the peritoneum firmly.

Dr. Bailey, (closing): I am very grateful to my distinguished colleagues for their generous discussion. This is a subject which could be discussed indefinitely without reaching the end.

Dr. Jackson's method of preliminary determination of a patient's ability to withstand an operation I think is a very important suggestion. This was also emphasized by Dr. Grant, who suggested that it is quite essential not to neglect pre-operation care, that by some minor operation one can relieve the immediate condition and help to get the patient in a better pre-operative state. It is the wise surgeon who knows when and when not to operate; haste in surgery is seldom necessary. There are few instances, except emergency cases, where we are not justified in taking sufficient time to go into each case and determine the fitness of the patient for operation.

With regard to history taking: If you permit one, two or three interns to go over the history of the patient, each one will bring out something new and perhaps equally important in the pre-operative consideration of the case.

Dr. Lewis spoke of the depletion of a patient and of the necessity of getting him or her stabilized before you proceed to operate. It is a reflection on the surgical profession of to-day that we have not always been sufficiently careful about the proper pre-operative as well as the post-operative care, of a person upon whom we are to operate.

I mentioned in my paper the valuable lesson given to us by the Mayo Clinic relative to the use of calcium lactate intravenously. We can give definite dosage and not depend on the slow indefinite absorption by the tissues. Calcium lactate is equal, if not superior, to any serum being used in an effort to get the coagulation time of the blood down to a safe margin.

Diabetes, as mentioned by Dr. Sweetser, is one of the diseases in which there is no excuse if one fails to recognize its presence.

Personal interest in the patient, as mentioned by Dr. Grant, is also important. In the course of hospital routine, as one of the speakers mentioned, much of the work is usually delegated to an intern. Oftentimes we realize that we are permitting the intern to shoulder the responsibility of the care of patients. The clinical eye which is gained by years of experience is so valuable that it is unfair to the patient to delegate all care and respon-

sibility to those who have not yet reached the age where judgment predominates. The first hour is zero hour for any patient following operation. It is equivalent to dismissal in our institution if there is any neglect during the first post-operative hour. Nurses who can discover any signs that may indicate cardiac or respiratory failure during that time are kept constantly at the bedside and have no detracting interest except to bring that one patient safely through the hour of slowly returning reflexes, and the dangers which beset it.

I had hoped particularly to impress one thought upon the mind of the busy surgeon: The pre-operative and post-operative stages are not insignificant periods, and more thought and personal attention to their supervision will bring credit upon the operator and greater comfort to the patient.

SOME MODERN METHODS OF MINIMIZING MORTALITY IN SURGICAL CASES, WITH REPORT OF THE MORTALITY IN 1518 SURGICAL CASES AT THE HOLY CROSS HOSPITAL, SALT LAKE CITY, UTAH, FROM JANUARY 1, TO SEPTEMBER 1, 1921

A. A. Kerr, M. D., F. A. C. S.

SALT LAKE CITY, UTAH

In selecting a subject for presentation before this body of experienced surgeons, I could think of no more important topic than the one I have chosen, which gives, briefly, the experience of the coördinated work of our staff.

We are living in an age of organizations. Harmonious coöperation is accomplishing that which would be impossible to individual effort. The great World War was won by team-work on the part of the Allies.

We are all desirous of having as low a mortality in our surgical work as is possible, consequently we welcome all methods of improvement, either in the manner of diagnosis, the preliminary treatment, the operative technic, or the post-operative treatment of our cases.

The management of our Class A hospitals in coöperation with the staffs is working earnestly and persistently for an improvement in the care of our cases.

The general practitioner is making more accurate

and early diagnoses and seeking prompt coöperation with the surgeon for the relief of the patient.

The systematic campaign of education carried on by the Fellows of the American College of Surgeons, the American Medical Association, the American Hospital Association, and our local and State Boards of Health, as well as our Army and Navy medical officers, is instructing the people in the necessity of early prompt treatment of such diseases as cancer, tuberculosis, and venereal and other affections.

The people are appreciating more than formerly the value of the hospital as an educational and community asset.

The Utah Hospital Association through representation of the various Utah hospitals, is endeavoring to standardize the Hospital records to conform to the requirements of the American College of Surgeons, which has given us credit for 20 per cent improvement in our hospital service to the patient in the last year.

A compilation of statistics prepared by the League of Red Cross Societies, whose headquarters are at Geneva, shows that from 1908 to 1912 cancer caused more than 1,500,000 deaths in civilized countries. The makers of the report add that had people generally been better informed in respect to the early symptoms of cancer 500,000 of these deaths would have been averted by more prompt attention.

Between 1900 and 1919 Switzerland led among countries in cancer mortality, the rate being 125 per 100,000. England and Holland were next, the rate from these countries being 100 per 100,000. In Holland the disease is decreasing. The United States, showing a tendency towards increase, follows England and Holland. Italy shows the least mortality from cancer in the countries classified.

The American Red Cross organization through its various branches has generously aided in improving conditions both at home and in foreign countries.

The standardizing of hospitals has helped materially in minimizing mortality in surgical, as well as medical cases.

Efficient hospital management, a modern training-school for nurses, an excellent dietetic department, with a general desire to give the patient the best service, are essential in the modern hospital. A harmonious working staff, each member specially trained in his own department with properly coördinated work, gives good results.

The minimum standard required of hospitals by the American College of Surgeons is briefly as follows:

"1. That Physicians and Surgeons privileged to practice in the hospital be organized as a definite group or staff. Such organization has nothing to do with the question as to whether the hospital is open or closed, nor need it affect the various existing types of Staff organization. The word Staff is here defined as the group of doctors who practice in the hospital inclusive of all groups, such as the regular staff, the visiting staff, and the associate staff.

"2. That membership upon the staff be restricted to physicians and surgeons who are: (a) competent in their respective fields and (b) worthy in character and in matters of professional ethics; that in this latter connection the practice of the division of fees under any guise whatever be prohibited.

"3. That the Staff initiate and with the approval of the governing board of the Hospital, adopt rules, regulations, and policies governing the professional work of the hospital and specifically provides: (a) That Staff Meetings be held at least once a month (In large hospitals the departments may choose from each separately); (b) that the staff review and analyze at regular intervals the clinical experience of the staff in the various departments of the Hospital, such as Medicine, Surgery, and Obstetrics; the clinical records of patients, free and pay, to be the basis for such review and analysis.

"4. That accurate and complete case records be written for all patients and filed in an accessible manner, in the Hospital, a complete case record being one, except in an emergency, which includes the personal history; the physical examinations, and clinical, pathological and *x*-ray findings when indicated; the working diagnosis; the treatments, medical and surgical; the medical progress; the condition on discharge with final diagnosis; and in case of death the autospy findings when available.

"5. That Clinical Laboratory facilities be available for the study, diagnosis, and treatment of patients, these facilities to include at least chemical, bacteriological, serological, histological, radiographic, and fluoroscopic service in charge of trained technicians."

The Class A hospitals are working with these principles daily as their guides and by this coöperation much improvement has been attained.

From January 1, 1921 to September 1. 1921, a period of eight months, there were admitted to the Holy Cross Hospital (Salt Lake City) 1518 surgical cases. During this time there was a mortality of 44, or approximately a death-rate of 2.8 per cent.

These cases were classified as follows:

Appendectomy-drainage and closure-(2 deaths)	162
Abbe operations	3
Amputations for fractures and infection	30
Cholecystectomy	11
Cholecystostomy	14
Cystoscopy	12
Cystostomy	8
Cesarian Section	8
Decompression	1
Exploratory, inoperable	4
Exploratory with negative findings	5

Extraction of teeth (one case complicated

with bilateral extra-articular ankylosis of the mandible)	6
Gastroenterostomy	5
Herniotomy	73
Hemorrhoidectomy	19
Incision and drainage	24
Laparotomy for echinococcic cyst of liver	1
Mastoidectomy	14
Manipulation, with application of plaster splint	49
Miscellaneous	56
Operations on eye, ear, nose, and throat	673
Operations on the kidney	4
Operations for bowel obstruction	6
Operations for spina bifida	1
Operations on female pelvis (abdominal)	121
Operations on female pelvis (vaginal)	83
Operations on male pelvis, including prostatectomies	33
Open operation removal of fragments of bone, wiring, plating, etc.	41
Plastic operations	3
Radium for cancer of tongue	1
Radium for cancer of cervix	1
Resection of stomach	1
Resection of bowel	2
Skin graft	3
Salvarsan	5
Thyroidectomy	12
Thoracentesis, with partial rib resection	11
Transfusion	10
Tenotomy	2
Total surgical cases for eight months January 1, 21, to September 1, 21	1,518
Deaths	44
Percentage of deaths	2.8

In reviewing the causes of mortality in this series of cases we have been impressed with the fact that quite a number of these patients (at least ten) could

have been saved had they been brought to the hospital at an earlier stage.

This is especially true in cases of strangulated hernias, septic, general peritonitis following appendicitis, gangrene of the gall-bladder, perforating gastric ulcers, or intestinal obstruction from volvulus, ileus, or adhesions, cases of intussusception and precancerous conditions, such as lacerated uterine cervices, and septicemia from wound infections.

The principles of hyperemia as described by Bier, Willy Meyer, and others we have found helpful in localizing and checking infections and lessening mortality and morbidity.

The use of the Carrel-Dakin solution and dichloramin-T in infected wounds has given us good result in selected cases.

As an illustration of the effectiveness of modern methods in the treatment of appendicitis, it is interesting to compare the mortality as reported twenty years ago with the results obtained to-day in the modern hospital. I was present at the St. Paul meeting of the Surgical Section of the American Medical Association in 1901, at which time Dr. J. B. Deaver read a paper on the "Mortality of Appendicitis." He then advocated operating in the first twelve hours when possible, also operating in all cases, in whatever stage of the disease the diagnosis was made. His mortality at that time was 15.9 per cent.

Dr. A. J. Ochsner at the same meeting read a paper on the "Cause of Diffuse Peritonitis Complicating Appendicitis and Its Prevention." His mortality was 4.0 per cent.

His conclusions were embodied in the so-called "Ochsner's" treatment of peritonitis, with which you are all familiar.

This method, while it has many valuable suggestions, is not always reliable. It has given the family

physician a false sense of security when something more radical should be performed.

I remember the case of a man twenty-eight years of age suffering from acute perforative appendicitis with peritonitis brought to the hospital from an adjoining town. He had been treated by this method, arriving at the hospital about one week after the beginning of the attack. He died about one hour after admission without being operated on. Autopsy showed a perforated appendix and diffuse septic general peritonitis.

When the late Dr. John B. Murphy taught us how to treat and prevent septic general peritonitis by the well-known method of abdominal drainage, Fowler position, and proctoclysis with normal salt solution, he reduced the mortality of peritonitis from about 75 per cent to about 10 per cent.

The prevention of excessive acidosis by proper preliminary dietetic, hydrotherapeutic, and alkaline treatment, as well as post-operative use of sodii bicarb. and glucose (5 per cent solution), has also contributed toward lessening mortality. Fischer solution may be used to advantage in cases of nephritis.

Autogenous vaccines, serobacterins, and vaccines, in my experience, have proved beneficial in various types of infection.

In 1911 at the Surgical Section of the American Medical Association, Dr. George W. Crile reported 2,410 operations in a general surgical service with a mortality rate of 1.9 per cent. He emphasized three principles in his operative work as tending to lessen mortality:

1. Anoci-association method of anesthesia.
2. Blood transfusion when indicated.
3. Delicate sharp-knife dissection.

In operations on the thyroid our highly esteemed and distinguished fellow member of the Association,

Dr. Charles H. Mayo, with his large clinical experience and sound surgical judgment, has taught us many lessons in care and operative treatment of these cases.

In selecting an anesthetic for a patient three factors minimize deaths:

1. The best anesthetic adapted to the individual case.
2. Proper preparation of the patient.
3. A skillful anesthetizer.

Dr. Arthur D. Bevan, in speaking of the relative mortality of anesthetics, says:

Chloroform has mortality of 1-2,000 cases.

Ether has mortality of 1-3,000 cases.

Nitrous oxide and oxygen has mortality of 1-50,000 cases.

He advocated the use of nitrous oxid in quite a variety of cases in general surgical work.

Ether given by the drop method is the favorite anesthetic in our hospital, and seems to be the most popular anesthetic in the majority of American hospitals.

Thomas, of Philadelphia, reports the administration of nitrous oxid over 271,940 times in extraction of teeth principally, with only one death, which occurred five hours after the administration, and was due to apoplexy.

Dr. W. D. Haggard, of Nashville, Tenn., summarizes the advantages of nitrous oxid gas anesthesia, as follows:

1. Quickness of action.
2. Absence of uncomfortable sensations to the patient.
3. Almost immediate recovery.

4. Absence of lung complications.
5. Absence of danger to the kidneys.
6. Absence of post-anesthetic vomiting.
7. Improbability of subsequent fatty degeneration of the kidneys, liver, and heart.

Nitrous oxid gas should be given by an expert anesthetist only.

Contra-indications for the use of nitrous oxid:

1. Dilated heart.
2. Young children for fear of the mask.
3. It should not be used in cases of narrow air passages, or enlarged tonsils or adenoids.

Dr. Haggard recommends chloroform in:

1. Convulsive seizure.
2. Obstetrical practice.
3. Kidney lesions.
4. Elderly persons with dyspnea.
5. Obstructed conditions of the trachea, esophagus, and larynx.
6. Deep cellulitis of the neck.

Generally speaking it should be avoided in:

1. General surgical work.
2. Conditions of heart weakness.
3. Operations in semirecumbent posture.
4. Minor surgical operations.

I have had considerable experience with chloroform, but do not advise its use except by a careful or experienced anesthetist and for short anesthesias. I have had no fatality from its use.

As previously stated, ether given by the drop method is the most popular anesthetic in American hospitals.

Dr. W. J. Mayo in discussing anesthesia, says:

"I have operated when the hemoglobin was as low as 25 per cent, due to hemorrhage, and I have never seen an accident follow such an operation. But, if you do an operation in which from some malignant disease the hemoglobin is reduced to 40 per cent or 50 per cent, and the oxygen-carrying power of the patient is decreased, you stand a chance to lose the case because with cachexia the blood is poor in oxygen-carrying power."

Dr. T. A. Flood, who is head of the Pathological Department of the Holy Cross Hospital has made an outline of some of the modern tests required in the diagnosis of surgical cases.

Kidneys.—Nephritis: Examine for albumin, blood, pus cells and casts, Note the sp. gr. and amount of night urine (8 P. M. to 8 A. M.). Estimations of blood content of creatinine, nonprotein nitrogen, uric acid, and urea. Renal functioning. Carry out phenolsulphonaphthalein test; study function following nephritis test diet; carry out ordinary urine tests for urea, ammonia, etc. Hematuria; Centrifuge specimen; stain sediment with Gram's stain and Ziehl-Nielsen; culture on plate agar and Petroff's medium; inoculate guinea-pig. Hemoglobinuria; Centrifuge specimen and examine sediment to determine absence of red cells; shadow cells may be present with débris. Hemolytic jaundice: Increased fragility of red cells; presence of reticulated red cells. Infectious jaundice: Leucocytosis; inject guinea-pig with blood of patient; spirochetes in liver emulsion of guinea-pig at autospy of animal.

Abscess.—Plate out material on agar or blood agar; stain by Gram and Romanowsky, and, when indicated, acid-fast method; usually leucocytosis. Liver: Leucocytosis, 12,000 to 20,000; normal polymorphonuclear percentage; large mononuclears increased; pus obtained by aspiration is like anchovy sauce; amebæ may be found for several days after drainage is established, contents often sterile; pus cells rare.

Lung: Large amounts of pus and fragments of lung tissue in sputum.

Appendicitis.—Polymorphonuclear leucocytosis. Choleystitis: usually moderate leucocytosis; duodenal fluid obtained by duodenal tube may show bile-stained pus cells; presence of bile indicates bile ducts are patent. Echinococcus disease; Compliment fixation tests; examine aspirated fluid for hooklets in cyst; eosinophilia present.

Gastric Cancer.—stasis of stomach contents; reduced or absent HCl; lactic acid present; Boas-Oppler bacilli; and occult blood may show anemia approaching type of pernicious anemia.

Pancreas.—Deficiency of ferments best shown by examination of duodenal contents; examination of stools shows greatly increased fat; examine for diastase in urine and feces; look for glycosuria. If absent carry out sugar tolerance tests; make blood sugar test. Pyelitis. Culture urine obtained by catheterization of ureters on blood agar; stain smears from sediment and centrifuge specimen; look for phagocitosed bacteria.

Gall-Bladder.—feces may reveal small stones; occult blood sometimes occurs; nothing definite relative to gastric acidity.

Urine.—Bilirubinuria. Glycosuria present in 25 per cent of cases of obstruction with distention of gall-bladder due to chronic pancreatitis or carcinoma of head of pancreas.

The use of Brieger's test for cachexia is useful for the early diagnosis of cancer.

The epinephrin test (Goetch) is valuable in the early differentiation of hyperthyroidism from tuberculosis.

Note.—I wish to thank Dr. T. A. Flood and other members of the staff who have kindly assisted me in preparing this paper. To all the physicians who

have contributed to the results outlined in the report of cases I express my appreciation of their work. To the Hospital management and Sisters and the Historian credit is due for their coöperative work.

In conclusion I desire to emphasize the following points:

1. The advantage to the patient in staff organization or coöperative work for the early diagnosis of clinical cases.

2. The necessity of proper preliminary treatment of operative cases.

3. In acute abdominal and injured or infected cases the mortality may be diminished by prompt operative treatment.

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DISCUSSION

Dr. Vernon C. David (Chicago, Ill.): The essayist mentioned blood-transfusion in reducing mortality in certain complicated cases that one meets. I would like to mention the use of blood-transfusion in acute hemorrhage. Many times it becomes necessary, where there has been loss of blood after traumatism, to bring back the blood pressure of the patient to save his life. Salt solution is used frequently for that purpose. The point I wish to make in the use of salt solution as an agent of transfusion compared to blood for the same purpose can be illustrated by an experiment which can be done on dogs. If a dog is bled to death from the carotid artery until respiration and heart cease to function, and the same amount of salt solution representing the blood volume which has been lost, is introduced into the dog's veins, he revives, and after the anesthesia he is apparently as active as before the bleeding, but in six hours the dog dies. If the same amount of blood volume is replaced by blood, the dog suffers no harmful effects. I think many times we are lulled into a sense of false security by the use of salt solution in acute hemorrhages. It temporarily brings the blood pres-

sure back and leads us to feel the patient is in a much better condition than he really is. In massive hemorrhages, such as those following abdominal injuries, ectopic pregnancy, and so on, a very good adjunct after salt solution transfusion is to increase the blood volume by blood transfusion at the first favorable opportunity.

TRAUMATIC AND INDUSTRIAL HERNIA

REPORT OF THE SPECIAL COMMITTEE OF THE MEDICAL SECTION OF THE AMERICAN RAILWAY ASSOCIATION

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The great increase in social legislation in recent years has made the subject of traumatic hernia one of vital importance to every industrial organization.

The first Workmen's Compensation Act was passed in Germany in 1884. Similar laws were soon adopted in Austria and later in Denmark, Norway, and England. In 1916, thirty-three states and territories in the United States had enacted some form of Workmen's Compensation Act, and since that time, other states have been rapidly following the lead. Therefore, traumatic or industrial hernia, at first largely a question of theoretical interest, has become one of great practical importance. In spite of this, there has been no definite attempt made to standardize our knowledge of traumatic hernia, particularly as regards its etiology. In the recent past, the question of compensation has too often rested upon the power of the plaintiff's attorney to stir the emotions of the jury, rather than upon a carefully-

weighed judgment based upon a knowledge of the facts relating to the origin of traumatic hernia. The time has now come when these cases are being gradually taken out of the hands of emotional juries—the members of which, no matter how fair-minded, are naturally lacking in the technical knowledge of the etiology and pathology of hernia—and being passed upon by experienced physicians. Therefore, it is of greatest importance that all of the facts bearing upon the etiology of hernia should be collected and classified and made readily available.

The term "traumatic hernia" has been used in a very general way to include, first, the small group of cases in which the hernia is due to direct violence; second, an occupational hernia, or perhaps, as better classified by the French, "hernia of effort," which includes all of those cases in which the hernia appears during heavy lifting, slipping, falling, coughing, sneezing, or any cause whatever which increases the intra-abdominal pressure; and, third, "hernia of weakness," which is due to abnormal or defective development of the abdominal wall at the various hernial sites.

The first group of cases is so exceedingly rare that it may be disposed of in a few words. In true traumatic hernia due to direct violence the tissues must have been punctured by some more or less sharp object which has forced its way at least through the muscles and fascia, if not quite to the peritoneum. Personally, we have never seen a case of true traumatic hernia. We have known of one treated by one of our colleagues; the muscles about the inguinal canal were torn by the horns of a bull and a hernia developed shortly afterwards. So this group of cases can be practically ruled out of consideration. The latter group, hernia of weakness, due to congenital weakness of the abdominal muscles or weakness through disease, causing atrophy of the muscles, also very rare, as weakness alone without the presence of a pre-formed congenital sac, rarely results in a hernia

no matter how great the intra-abdominal pressure. These are practically all of the direct type.

The very large group of cases which is ordinarily designated as traumatic hernia and which should be more properly called occupational hernia, or better still, hernia of effort, furnishes the basis of nearly all of the medicolegal or compensation cases of hernia. The word "rupture," the old English name for the disease hernia, is responsible for the traumatic theory of the origin of hernia so widely held by the laity as well as by many medical men who have given but little study to the subject. This theory gained a foothold before operation for the radical cure came into general use and before the etiology of hernia was generally understood. With the rapidly increasing knowledge of the subject derived from a very large number of operations that have been performed in the last quarter of a century, our ideas of the causes of hernia have gradually changed. At present, it is almost universally recognized that the all-important cause of hernia of all varieties is the presence of a preformed sac of peritoneum known as the processus vaginalis. This view was held by two noted surgeons of the eighteenth century,—Pellatin and Cloquet; but only in recent years did Russell, of Australia, by his patient investigations, force us to conclude that practically all hernias are of congenital origin due to this open pouch of peritoneum which has existed since birth. Unfortunately, courts and juries, and compensation laws here and abroad, have not kept pace with the developments of surgery, and it is still not unusual to see large damages awarded in cases of so-called traumatic hernia. Russell maintains that an acquired hernia does not exist, and recognized authorities on hernia have come to agree with Russell's conclusions.

Prior to the adoption of the Workmen's Compensation Acts there were a considerable number of medicolegal decisions in cases of so-called traumatic hernia both in Europe and in America. Many of

our compensation boards have simply followed along the lines of decisions handed down by European courts. Sheen (*Practitioner,* London, 1909) who has made a careful study of the subject of traumatic hernia in England, states that "the arbiter in these claims, in the mass of ill-understood technicalities, following the lines of least resistance, has given judgment in favor of the workingman—the post hoc ergo propter hoc view being naturally considered the easiest one."

In Switzerland a person suffering from a hernia and desiring compensation, is entitled to indemnity only on the following conditions: (1) It must appear suddenly; (2) it must be accompanied by pain; (3) it must be of recent origin; (4) there must be proof that the hernia did not exist prior to the accident.

In Germany, in order to establish a claim, the sufferer from hernia must have had an examination within forty-eight hours of the accident; the hernia must have appeared suddenly, must have been accompanied by pain, and must have immediately followed some accident. Proof must be furnished that there was no hernia prior to the accident.

While there are no published records showing the results of the New York State Compensation Board, Sellenings, through the courtesy of a medical officer of the commission, has obtained certain important data. The commission thus far has considered traumatic hernia as extremely rare. The opinion was ventured that it occured in possibly one of ten thousand cases.* Commenting upon these statistics,

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*Since this report was made, the following data have been kindly furnished to us by Mr. Frank V. Whiting, General Claims Attorney of the New York Central R. R. Co. He writes:

"The New York Compensation Commission has never published any statistics or information in relation to hernia.

"For some time, the Board has rather inclined to the view taken in your Committee's report, that is, that hernia is not generally the result of a trauma, yet, there was an unwritten law established that if the employer offered a correcting operation, and it was refused, an award would be made for eight week's disability and the case closed. This practice has prevailed up until very recently.

"In the case of Al. v. P., 223 N. Y. 97, decided two or three years ago, a hernia was claimed as the result of a strain, and the award was made, but subsequently denied by the New York Court of Appeals, on the ground that there was no cause or relation between the strain and the rupture. This resulted in a strengthening of the prevailing opinion that trauma was a doubtful cause of the hernia.

"However, recently, beginning with the case of J. v. D. C., in the Court of Appeals, decided March 15, 1921, there has been a trend the other way. The J. case specifically decided that the facts indicated that the claimant, while lifting a box of clay weighing over 700 pounds, strained his side and a hernia resulted, and the Court stated that there was no doubt that it was an accidental injury within the meaning of the statute, and rendered a decision accordingly."

These quotations are sufficient to show how completely at sea both Courts and Compensation Boards are at the present time, on the subject of Traumatic Hernia.

Sellenings states:

1. Traumatic hernia is but a surgical curiosity and assumes no practical importance; 2. Only a small number of the cases have been carefully investigated; 3. A great proportion of the cases seem to be relegated to the convenient classification of 'vocational hernias.' Whatever may be said of the attitude of the New York Commission applies equally well to many other sections of the country.

One of the most recent and on the whole judicial discussions of the subject Traumatic Hernia, or, as the author terms it, "Compensable Hernia," is contained in a book on "Industrial Medicine and Surgery" by Harry E. Mock (Assistant Professor of Industrial Medicine and Surgery at Rush Medical College) published in 1919.

Mock calls attention to the fact that "the decisions of established medicine date back to the precompensation days and were based on the testimony of expert authority made in the courts of England especially, and later in our own courts, to the effect that a traumatic hernia could only occur from a direct violence resulting in a definite tearing or rupture of the abdominal wall. All other hernias were claimed to be due to congenital defects, pre-formed sacs, and to be similar to all other diseases which might occur coincidental with occupation but not related to it. Such testimony was sustained by practically every court and their views were considered as the decisions of established medicine." He states that, naturally, few claims for traumatic hernia were made, although

employees in those days, just as frequently as at the present time, blamed their work for the condition.

The greatly increased number of claims for compensation for hernia at present, he regards to be due partly to the new attitude on the part of industry in the direction of recognition of certain moral obligations as well as the realization that any improvement in the condition of employees renders them more useful and more efficient. He states that among broad-minded employers the question of whether there was such a thing as traumatic hernia for which they could be held legally responsible caused little concern.

"They were not governed by the decision of established medicine nor of established law, but based their decisions upon a just and good business sense. If they employed a man with a hernia they knew the industry was not responsible for it. If it grew gradually worse without any definite accident or excessive occupational effort it was due to natural causes and again they were not responsible. But, if as a result of accident or severe strain this hernia became strangulated, at once doubt as to responsibility entered the case, and the decision was, therefore, rendered in favor of the employees. If they hired a man who showed no sign of rupture at his employment examination, but who later suffered an accident or a severe occupational strain and as a result the hernia appeared, compensation and free surgical care were given because in the man's mind the accident caused the trouble, and because they recognized that to a certain extent the occupation was contributory to the final development of the condition.

"From the standpoint of efficiency it was found that a man with hernia was about 25 per cent less efficient than the man without one. Therefore, these concerns might refuse to employ men with a rupture, but they became more and more liberal regarding

the repair of such a condition when it developed in an old employee."

Mock states that, "Such was the attitude of several concerns at the time of the passage of the employees' compensation acts. In fact those very laws were an expression of this new humane influence which had entered industry.. The administration of these acts was placed in the hands of industrial commissions whose members were laymen rather than lawyers. Influenced by the generous attitude of certain industries, and guided by this sentiment and a consideration of moral rights, combined with their meager decision of these various commissions were often at variance to those rendered by the courts in the past.

"Thus employees began to seek compensation for many conditions which heretofore had not been considered compensable, and included among these were hernias which developed during employment."

Mock states, "The question of traumatic hernia, therefore, simmers down to three considerations:

"1. A proper definition of what is meant by traumatic hernia.

"2. To what extent must an accident or an occupational hazard which only partially contributes to the development of a condition be held responsible for same.

"3. In which cases should compensation be paid by the employer."

Mock fully agrees with our own opinion and that of practically all surgeons who have had much experience with hernia, that hernias as a result of direct violence are very rare. He states that many of the best authorities have enlarged the scope of traumatic hernia so as to include those cases which result from the indirect application of force causing greatly increased intra-abdominal pressure. This adoption of a broader definition, however, Mock

believes would mean the inclusion of many additional hernias in the compensable group thus greatly confusing the question. We believe it would be much better to restrict the name of traumatic hernia to the very small group due to direct violence.

Other types of hernia for which the occupation is more or less responsible, are described by Lotheissen and other writers as "accidental hernia."

Mock has personally observed only five cases of true traumatic hernia due to direct violence at the point where the hernia developed. He cites these five examples as follows:

(1) Man struck in the right groin by the sharp end of a crowbar; (2) a brakeman was crushed between the bumpers of two cars, and a ventral hernia appeared; (3) a man was running through the aisle at fire drill and struck his left inguinal and scrotal region against a truck handle. A large contused area, swelling, and hemorrhage into the scrotum immediately followed. Within three days a definite left, direct inguinal hernia appeared: (4) a pregnant woman was kicked in her left lower abdomen by her husband and very shortly a ventral hernia appeared and naturally increased in size as pregnancy developed; (5) a cowboy came to my clinic with two enormous oblique inguinal hernias. He gave a history of some two years previously having had a horse he was riding rear and fall over backward, pinning him beneath the saddle. The pommel of the saddle had crushed into his lower abdomen. Immediately there was bulging in both groins and these continued until they had reached the present size. The man denied any sign of rupture previous to the accident.

In at least the fifth case of Mock's series (enormous double oblique inguinal hernias) it would seem almost certain that there must have been present congenital sacs, or, rather, an early stage of hernia on both sides prior to the accident, and the enormous increase in intra-abdominal pressure in this case further developed the pre-existing condition. Mock himself admits that "It is quite evident that even in these cases of inguinal hernia following direct violence, some doubt will always exist as to the possible presence of a congenital predisposition for hernia."

He very truly affirms that, "Industrial Commissions all over the country are depending on the surgeons in industry to arrive at a just and equitable decision concerning this subject of compensable hernia."

Mock believes that, "The first essential is to make a careful physical examination of all employees and to record those who have real or potential hernias. Whenever a hernia develops in one of these employees who was recorded not to have a hernia, a careful analysis of his case must be made to determine: (1) was it entirely due to pre-existing defect? (2) was it entirely due to some severe direct or indirect violence? (3) was a latent condition already present and only aggravated by the unnatural occupational hazard? (4) was it due entirely to natural causes? (5) or was it due to a combination of all of these, and if so, which was the most responsible?"

Mock admits that, "The great majority of hernias develop slowly, 'the gradual dilatation of a pre-formed sac.' The congenital defect or predisposition is the chief cause for such hernias and the relations of natural occupation or of the natural acts of ordinary life are immaterial in their formation. These correspond to the gradual development of 'flat-foot' a result of faulty shoes, constant standing and walking or other natural causes; or to the development of tuberculosis in employees engaged in occupations which in no wise predispose to this condition."

MacCready, the greatest English authority on hernia, states that an acquired hernia is never due to an accident or single increase of intra-abdominal pressure.

Graser, one of the highest German authorities, states that a hernia complete in all its parts can never arise at the moment of accident or by a single increase in the intra-abdominal tension be it ever so great.

Moschcowitz, of New York, who made a very careful study of hernia in relation to the Workmen's Compensation Act (Medical Record, April 3, 1915), concludes: "Traumatic hernia is exceedingly rare. It may occur in any part of the abdomen, but usually *not* at the site of the normal hernia openings. Workmen's Compensation Commissions are not and cannot be acquainted with all the facts relating to hernia. This is evidently the sphere of the medical profession; the Workmen's Compensation Commission should be required to place implicit reliance upon the decision of established medicine. In cases of appeal from the decision of the Commission, all the medical part of the testimony should be given by experts of the court's selection, and not of the selection of the claimant or defendant."

A fact particularly emphasized by Doctor Hopkins is that the great majority of hernias in industrial practice, particularly in railroad work, are found in foreigners, and nearly all in men who have not previously passed a physical examination. One of the reasons why they occur more frequently in foreigners is, we believe, the fact that the class of foreigners engaged in the lower grades of railroad labor are, as a rule, either undernourished at the time, or went through a period of undernourishment during childhood, which tended to lessen the normal development of the abdominal wall. Another reason for the higher percentage of hernias in foreigners, particularly those coming from Russia and Southern Europe, may be found in the practice so widely prevalent among these people, of trying to produce artificial hernia in order to escape army duty. Doctor Gerster, of New York, called attention to this factor many years ago; and recently, at the Hospital for Ruptured and Crippled, Doctor Hogust observed a double direct hernia, regarding which the man stated he had produced it himself. The method of production was: taking a hard, slightly blunted stick, placing it over the inguinal canal and then striking moderate blows from time to time with

a mallet until the muscular structures in the neighborhood of the canal are torn or pushed to one side and finally a hernia develops. Here again we must observe that it does not occur as the result of a single blow or single injury. It is only the repeated blows with this more or less sharp instrument that finally produce such a weakness as to cause a direct hernia to follow.

Of all the attempts made by the different State commissions to solve this vexed problem of traumatic or industrial hernia, the industrial commissions of Nevada and California stand out as most in accord with our present knowledge of the causes of hernia. The following is a ruling of the California Industrial Commission:

The consensus of medical and surgical opinion runs to the effect that hernia is very rarely, in any proper sense, the result of an accidental injury; that the accident is at best no more than the occasion, instead of the cause of the malady; that the origin of the difficulty is congenital and more in the nature of a disease than an injury; that every claim for compensation based upon an alleged rupture is to be viewed with suspicion.

The Nevada Commission rules:

Medical science teaches now what it has taught for the past twenty years and now accepted as a medical and scientific truth, corroborated as such by the foremost surgeons and anatomists in the world; that is, that hernia, or so-called rupture, is a disease, ordinarily developing gradually, and is very rarely the result of an accident.

The following rules have been promulgated by the Nevada Commission:

Rule I. Real traumatic hernia is an injury to the abdominal wall (belly wall) of sufficient severity to puncture or tear assunder said wall and permit the exposure or protrusion of the abdominal viscera or some part thereof. Such injury will be compensated as temporary total disability, and as partial permanent disability, depending upon the injured individual's earning capacity.

Rule II. All other hernias, whenever occurring or discovered and whatsoever the cause, except as under rule I, are considered to be diseases, causing incapacitating con-

ditions or permanent partial disability, and the causes of such are considered, as shown by medical facts, to have either existed from birth, to have been years in formation, or both, and are not compensatory, except as provided under Rule III.

Rule III. All cases coming under Rule II. in which it can be conclusively proved, first, that the immediate cause which calls attention to the presence of the hernia, was sudden effort or severe strain or blow, received while in the course of employment; second, that the descent of the hernia occurred immediately following the cause; third, that the cause was accompanied or immediately followed by severe pain in the hernial region; fourth, that the above mentioned facts were of such severity that they were noticed by the claimant and communicated immediately to one or more persons, are considered to be aggravations of previous ailments or diseases, and will be compensated as such for time or loss only, depending on the nature of the proof submitted and the result of the local medical examination.

Our Committee is entirely in accord with Rules I and II of the Nevada Commission. It, however, calls attention to a serious conflict in Rule III of the second proof, which must be given in order to establish a right for certain compensation. Rule II states specifically that by medical facts it is shown that a hernia either exists from birth or is years in formation; whereas, in the second proof of Rule III it speaks of a descent of hernia occurring immediately following a strain or blow. This assumes that hernia may be the result of a single increase of abdominal pressure which the Commission in Rule II stated to be impossible.

Many writers state that a recent hernia is tender and painful on manipulation, and ecchymosis is not infrequently present. This statement is frequently found in text-books and particularly in articles upon Traumatic Hernia. We believe it has no basis in fact. In an experience of 31 years at the Hospital for Ruptured and Crippled, where we have an average of 5000 new cases a year, there has not been a single case of recent hernia which was "tender," painful, and accompanied by ecchymosis in which

there had been a history of antecedent injury or accident of any form. We have seen a number of cases that were attributed to an injury, and we are of the opinion that the patients honestly believed that the injury was the cause of the hernia; yet the size of the hernial ring, the thickness of the sac, with adhesions to the surrounding structures, all proved beyond the shadow of a doubt, that the hernia was of long standing, although probably not previously recognized by the patient. A recent case, only observed in October, 1921, is a very good illustration of this point. A man, 25 years of age, employee of the New York Central Railroad Company, with a history of never having had any swelling whatever in the region of the hernial canals, shortly after heavy lifting, noticed a swelling in the right inguinal region. He came to the Emergency Hospital of the N. Y. C. R. R. Co., where the attending surgeon found a well-marked inguinal hernia, the size of a small egg, in the right inguinal region, extending well into the canal and upper scrotum. In the opinion of the surgeon, this was one of the most definite cases in his experience pointing to a causal relationship between the strain and the hernia, and it might have been so regarded, had not the patient consented to an operation. On October 14, 1921, Doctor Coley operated and found a pre-formed sac undoubtedly of congenital origin, extending well into the upper scrotum, 2 1-2 inches long and 2 inches broad, considerably thickened, firmly adherent to the overlying cremaster muscle. The nature of the sac clearly proved it to be of congenital origin and, in all probability, the hernia itself had existed for months or possibly years although the patient may never have recognized it until the time of the unusual strain, when a somewhat larger amount of omentum or bowel was forced into the sac, causing slight pain which first called his attention to the hernia.

Hernia is practically always due, first, to the presence of a pre-formed sac or open pouch of peri-

toneum, which, in the inguinal variety, follows the testis in its descent into the scrotum, which pouch has failed to close in the normal way; and, secondly, to the presence of structural weakness in the neighborhood of the hernial orifices due to poorly developed muscles or fascia. Given these all-important anatomical causes, which are in themselves sufficient in many cases to constitute a potential hernia, the actual hernia may develop by reason of a great variety of exciting causes; among these may be mentioned the daily increase in intra-abdominal pressure incident to the ordinary routine of life, for example, straining at stool, coughing, sneezing, lifting, etc. The main point that cannot be emphasized too strongly is that the hernia is never the result of a single strain or single increase in intra-abdominal pressure due to any of the causes mentioned; on the other hand, it is the cumulative effect of a great number of strains spread over a considerable period of time. In nearly all cases hernia is of gradual onset, and is rarely accompanied by pain, and most frequently remains unnoticed until it has reached a considerable size or until some accident or strain by slightly increasing the contents of the hernia sac, causes it to be noticed for the first time. Hence, the accident or strain is usually the occasion which first attracts the attention to a hernia long present but hitherto undiscovered. It has been a matter of almost daily observation at the Hospital for Ruptured and Crippled to find a patient applying for a truss or for operation for a hernia on one side, when careful examination discloses the fact that he has a hernia on the other side, almost, if not quite as large as that for which he applied for treatment. The size of the hernia and the character of the sac as determined by operation prove beyond question that this hernia existed for a long period and was quite unrecognized by the patient. Hence it is true, that, in many cases a person who claims that his hernia is due to an accident or an injury may sincerely believe this to be the fact, because he was unaware of the presence of a swelling

prior to the accident, although it had really existed for months or years before. In many other cases, however, the contrary is true and claim for indemnity or large damages is made upon a corporation, for a hernia which the claimant well knew had existed for a long period prior to the accident. In some cases, evidence of his having worn a truss for a long period of time is apparent. We, personally, have seen many cases of this type in our medicolegal work and in some instances the sympathetic jury has awarded very large damages. In all of our experience we have never seen a single case in which there was any sound basis for the claim that the accident or injury was the cause of the hernia. In many cases the jury has been convinced by expert testimony that a hernia could not have been caused by the accident mentioned and have rendered a verdict accordingly, but on the other hand, in other cases, all of the expert evidence has been brushed aside and the jury has allowed its sympathy for the claimant to outweigh the seemingly slight loss of a few thousand dollars compensation to the supposedly wealthy corporation. One case which we recall is that of a man of about 50 years of age, who claimed to have been thrown forward against the back of the seat in front of him in a slight collision. The slight increase in intra-abdominal pressure was made the basis for his claim that a large, double, inguinal hernia was the result of the accident, although there was no evidence of local injury at the site of either hernia. In spite of expert evidence to prove the fact that a double hernia is never the result of trauma, that these hernias were both too large to have been of recent origin, the jury, as we remember, awarded very large damages ($15,000.00). The verdict was so palpably against the evidence that the decision was reversed by the Supreme Court.

At present the situation in regard to dealing with the question of traumatic or industrial hernia may be described as chaotic. There are, however, a few States in which the members of the Workmen's Com-

pensation Commission apparently have made a scientific study of the subject before formulating any rules and in these States the subject is treated in a most fair-minded and judicial way; in other States, however, the rulings are apparently based on the old and long-discarded ideas as to the etiology of hernia with the result of great financial loss to the interested corporations and in the end distinct harm to the individuals.

What then is the remedy? The only thing needed to bring about greater harmony in the procedure of industrial commissions, is to spread broadcast a clearer knowledge of the well-known medical and surgical facts relating to the etiology of hernia. We must recognize that medical and surgical truths permeate but slowly, especially when they have to overcome long-established traditions too often supported by court decisions. The first is to convince the commissions and the courts of the well-established surgical fact that hernia is a disease and not the result of an accident. When this has been done a radical review of the present State laws regarding compensation in cases of industrial hernia will be forthcoming.

RECOMMENDATIONS

1. Render proper compensation for all cases of true traumatic hernia due to direct violence. Such cases are so few in number as to be practically negligible.

2. Make a physical examination of all applicants for positions in industry no matter in what capacity; such examinations will determine the fact whether or not a hernia was present at the time of examination.

Doctor Hopkins, in a recent paper on Traumatic Hernia, reveals the important fact that of all the men who passed the physicial examination prior to entering the railroad service, the claim of traumatic hernia amounted to less than one per cent.; while, on the

other hand, ninety-one per cent. of the cases of alleged traumatic hernia were found to occur in foreigners (Greeks, Italians and Poles), who did not have a preliminary physical examination before being admitted to the service.

3. Any case of hernia developing in the course of duty, incident to the man's daily work, should be treated as a disease due to special anatomical weakness on the part of the individual, for which the Company is in no way responsible. If it is considered wise under certain circumstances to recognize any moral responsibility, let it be on an economic or humane basis. This moral obligation should be understood to be strictly limited to such employees as had been found apparently free from hernia at the time of previous physical examination.

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DISCUSSION

Dr. William Hessert (Chicago, Ill.): I shall take only a few minutes of your time to discuss this report. There is no question in the minds of all of us that a true traumatic hernia produced by external violence is a very uncommon thing—very rare. I have never seen one myself. As a matter of fact, the vast majority of hernias are the result of developmental defects, and in that connection I will mention two types which, in my experience, are the most important in that line. In the first place is absence of the conjoined tendon. One of the etiological factors in the production of hernia, more so in direct hernia than in oblique, is the absence of the conjoined tendon, which I think you will find, if you look for it, in many more cases than you think. In my experience in these cases you will find the fibers of the external oblique are atrophic or improperly developed. When such a man is examined clinically, a finger can be introduced, the scrotum inverted, and the finger introduced up to the second joint, and in these cases we have a very prolific source of the production of hernia. That is one point.

The question of congenital sacs, I think, explains the majority of our hernias. At the time of birth, before the tunica vaginalis is supposed to close in the average male infant, I have an idea, based on clinical observation, that in all hernial sacs nature makes an attempt to close the sac at three points,—the internal ring, the external ring, and just above the scrotum. This is borne out by clinical experience and later results in the way of pathology in this region. If it closes above the scrotum we have potentially a hernial sac which extends down to the scrotum; and the man the doctor spoke of had a potential hernial sac, and when the whole thing was opened up he had a simple hernia. That was not a traumatic hernia, although the man had a congenital sac.

In some of these cases you get what is known as hour-glass hydrocele, filling up the sac with fluid, and the fluid gradually distending the sac you have part of the fluid inside and part outside the abdomen. You cannot account for hour-glass hydrocele in any other way possibly. If you examine these hernial sacs, you will find them constricted at point 1, point 2,

and at point 3, as I have indicated on the blackboard. If the hole remains open you have a congenital hernia with everything open. If you will examine hernial sacs you will find evidences of constriction at the points I have mentioned, so that in my opinion the vast majority of hernias are congenital and due to improper closure of the tunica vaginalis.

Dr. P. A. Bendixen (Davenport, Iowa): I think the term "traumatic hernia" is a very confusing one, and Dr. Hopkins, in reading his report, stated that a true traumatic hernia is very rare. If a traumatic hernia is rare, should the term then be applied to accidental hernia? I believe that a better understanding could be had by the industrial commissioners and adjustors if the term of a "vocational" or "accidental hernia" be used. I feel that we must get away from the term "traumatic hernia."

Another point that I wish to bring out with reference to hernias is the fact that the man who really receives a hernia in his daily employment is usually the laboring class, and I further know that the laboring class of all companies are not examined, while men who are less susceptible to a hernia are always examined,—for instance, conductors, engineers, and firemen; but, on the other hand, section men or the ordinary laborers are not examined. The men who have the weak abdominal walls, or who have atrophy of the muscles about the internal and external rings, are the very fellows that are not examined. I believe that every man who is working for a corporation, regardless of his occupation, should be examined and a report made as to the exact condition of the rings.

A decision has been rendered by the Supreme Court, I believe, in the State of Washington, with reference to a traumatic hernia. The decision was that, if you hire a man, even if he has enlarged inguinal rings and you employ him, and he later on receives a rupture, the company is responsible for the injury. The decision was based on the grounds that when you get a piece of machinery and said machinery becomes defective while in the course of its operation, it must be repaired, and the same holds good for the human being.

I believe that the subject that Dr. Hopkins has placed before you is an important one and should have the endorsement of all the physicians.

Dr. Willard D. Haines (Cincinnati, Ohio): I think we are deeply indebted to Dr. Hopkins for bringing this subject before us. The State Commissioner in my state (Ohio) formerly passed all of these cases. He has not recognized any of them as in any way entailing responsibility on the part of the employer until recent times. Within the last year we have had a great many of the cases at the Cincinnati General Hospital, therefore it becomes an exceedingly important subject

from an economic standpoint. Personally, I have always felt and have been able to demonstrate in a great number of my cases the soundness of the judgment just indicated here on the blackboard by a previous speaker (Dr. Hessert). Hernia is a congenital defect like club-foot or hare-lip. The presence of a defective conjoined tendon, and poorly developed internal, oblique, or transversal muscle favors development of hernia of the indirect type. Personally, I have regarded indirect hernia as a manifestation of a congenital defect; conversely the direct hernia, I think, is practically always an acquired defect.

I started an investigation years ago and demonstrated clinically in 60 per cent of the cases a patulous processus peritonei in the hernial subjects on which we were operating. If you will look for this phase of hernia you will find the number probably greater.

I am sure it is difficult to deal equitably with workmen regarding this subject who have not been examined for hernia before they were employed. With a congenital defect a man goes along for years and becomes a little stouter and stouter until he has the typical pot-belly of the subject of hernia. Potentially he was a hernia subject from the time of his birth. Some sudden stress thrown upon the abdominal musculature and the hernia slips out, and the man says he has ruptured himself, and the burden of proof rests with the State to prove that he is not justly entitled to compensation, hospitalization, and surgical service at the State's expense. I think we have an important question to decide so as to be just to employee and employer.

Dr. Willard Bartlett (St. Louis, Mo.): I have operated upon three cases of traumatic hernia. I seem to have had a most unusual streak of good luck in that particular. I shall not go into details in order to spare your time, except to say that all three patients were known to me from the beginning of their trouble. They were all operated upon, and the peritoneal sac was demonstrated in each case. I saw a fourth case demonstrated in Boston at the last meeting of the Society of Clinical Surgery, where a man was caught between the bumpers of cars and said to have developed bulging areas which were demonstrated as traumatic hernia.

Regarding the three cases I operated on: The first was a man who had been working in a steel foundry. He was riding on the end of a crane that carried a ladle. These fellows ride from the point where the steel is poured into a great big cauldron to where it is dumped on the solid ground. This chap was thrown in that way against a brick wall and developed finally a large traumatic hernia up under the right

rectus muscle. The second patient, a colored man, was properly administering a well-deserved chastisement to his wife. He kicked her in the groin as a part of it, and she developed a direct traumatic hernia on which I operated.

A third case came to our notice a few months ago. A boy was swimming, and after coming out of the water he slipped on some object and developed an acute hernia, for which we operated.

I wish to say that it is a pity that more men were not present to hear this report. It is the most adequate and highly constructive addition to our knowledge of the etiology of hernia that has ever come to my notice in one paper.

Dr. Oliver J. Fay (Des Moines, Iowa): Like Dr. Bartlett, I have had three cases of traumatic hernia, one in a man who was driving a steam engine, such as we use in Iowa for threshing purposes. He lost control of it, and the small handle struck him in the groin and produced a hernia. The second man was struck by a wagon in the same area, and a third one was kicked by a mule. All three patients were operated on.

If Dr. Hopkins will pardon me, I will say that I think the report he has presented is too long for the purpose for which he wants it. It should be very much abbreviated, so that it can be placed before industrial commissioners and will be read by them. That is the criticism of the report as I see it.

In the second place, I would like to say that Dr. Hopkins must keep in mind that in considering any compensation in Iowa we are not altogether limited by what a doctor says and by what the commissioner says. These men have a perfect right to arbitration and to the courts. Our commissioner has made a ruling in twenty-seven cases which has been confirmed, and which is a most remarkable result for the commissioner of Iowa.

Dr. Elmer D. Twyman (Independence, Mo.): It seems to me, the class of hernias described by the doctor are compensable aside from acute traumatic hernia, although there is a preformed sac, no hernia having come down, the increased abdominal tension having partially closed the ring. There may be also those cases in which the muscle is directly injured and are classed as traumatic, or those in which a sharp object may impinge upon the nerve supply of the muscles, which actually results in a hernia and, certainly, should be of the compensable type.

Dr. D. S. Fairchild (Clinton, Iowa): I have seen one case of traumatic hernia. The man was walking through the

train rather rapidly in going to the dining-car, when the engineer put on the emergency brakes, and he struck his side against the arm of the sleeper, which was followed by a hernia. He was a man seventy-five years of age, but had never had a hernia up to that time.

I do not agree with Dr. Fay's suggestion of cutting down this report, because, really, it is a valuable contribution, and to cut it down very materially would be unfortunate, it seems to me.

In going over a list of three thousand examinations I have in mind men examined for classified service. Fifty out of that number had hernia and were rejected because of it, so it shows a large percentage of hernia cases in the higher class of employees. That percentage is much higher when it comes to the consideration of the lower grade of men who come before us so often with hernias. I have found the same situation in seventeen hundred men examined for the Army. Almost 10 per cent of the men had suffered from hernias.

EXCISION OF ULCER OF THE DUODENUM

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The immediate and ultimate results of gastrojejunostomy performed for ulcer of the duodenum are very satisfactory. Two considerations are essential to these good results: first, the operation must be decided on after the ulcer has been demonstrated; and, second, the mechanical arrangement of the stomach and intestine and the technic for joining the two must follow the plans made by surgeons with the widest experience.

In view of the fact that there is so much evidence to support the belief that ulcers in the duodenum may be the result of extension of infection from some focus in the abdomen, or more remote point, it is necessary that such co-existing infection should be cared for at the time of the operation on the stomach or very soon afterward. Certain regulations of diet following gastro-enterostomy are undoubtedly essential. Indiscretions soon after the operation have often been followed by a return of the former symptoms, and have seemed to play a part in the formation of secondary ulcers.

Gastro-enterostomy does more than effect symptomatic relief. It has been said by some observers that all ulcers of the duodenum heal after the gastro-enterostomy. I find it difficult to decide just what effect gastro-enterostomy has on the ulcer. However, in our cases in which secondary operations were performed at various times, subsequent to the gastro-enterostomy for ulcer, there was always evidence of the ulcer in the form of scar and induration. Just when the ulcer may be termed healed, I believe, will depend on when

all of the ulcerated area has been replaced by scar tissue. Perforation of the ulcer is a common occurrence, and yet, so far as I have been able to learn, such perforation practically never occurs after gastro-enterostomy. I know of only one authentic case (personal communication from Moynihan). This suggests that if the gastro-enterostomy did not effect a definite change in the ulcer itself, perforation would occur more often. On the other hand, it is well known that if an ulcer of the duodenum has caused severe bleeding, a return of the hemorrhage may be looked for in a definite percentage of cases (about 12 per cent) after gastro-enterostomy. The hemorrhage may come several years after the operation; furthermore, it may come when the patient has been completely relieved of his dyspepsia. The phenomenon indicates that the ulcers do not all heal completely as the result of gastro-enterostomy.

Careful macroscopic and microscopic study of the tissues has proved that inflammatory lesions of the duodenum occur in two distinct types; one, the true ulcer, and one more distinctly inflammatory, probably better designated duodenitis. We might assume that the duodenitis type of ulcer is the healed true ulcer, but I believe that it is a separate lesion and never has been and never will be a true ulcer. The first type is the true ulcer, and is in every way similar to an ulcer in the stomach. There is definite congestion and stippling of the peritoneal coat, and the induration is usually rather extensive so that the lesion can be palpated and recognized as an ulcer with a crater. The second type is more markedly congested and stippled than the true ulcer; usually there is very little if any induration in the tissues. In many cases the palpation of this lesion does not differ from palpation of the normal duodenum. On excising the area, instead of a crater, as in the first type, the entire surface of the mucous membrane is found to be covered with normal mucosa. The condition might be called a healed ulcer if it were not producing symptoms.

The thickness of the ulcerated area of the duodenum is very little, if any, greater than that of the normal wall of the duodenum. If the surface of the mucous membrane is examined closely it may be found to contain one or more pin-point ulcers and scar tissue. Both the submucosa and muscularis are usually infiltrated with round cells, and this infiltration may extend some distance into the tissues of the intestinal wall. Histologically, this ulcer is similar to the submucous ulcer sometimes found in the urinary bladder. Clinically, there seems to be little difference between the two types. The histories in our cases of duodenitis indicate that this type of ulceration is not a stage from which true ulceration later develops. The duration of symptoms averages the same as in cases of true ulcer. The shadow of the deformity of the duodenal cap in the röntgenogram produced by the two forms of ulceration is the same except that the niche which represents the crater of the ulcer, while often seen in the ulcer type, is absent in duodenitis.

The designation of these two types of ulceration of the duodenum has no bearing on the diagnosis or treatment, but is of interest from the pathologic point of view, and may offer some suggestions with regard to etiology. Formerly I believed that hemorrhage was a rare occurrence in cases of duodenitis, but recently I have had reason to believe that very severe hemorrhages may occur in these cases. In the past few months I have seen several patients who have had hemorrhages so severe that they were almost exsanguinated, and yet the lesion in the duodenum was in the form of duodenitis rather than of true ulcer. In some of the cases the area of the inflammation extended throughout the entire circumference of the duodenum, and yet there was no demonstrable ulceration of the mucous membrane.

In view of the fact that gastro-enterostomy, when properly selected and performed, has offered such exceedingly good results in the treatment of duo-

denal ulcer it seems best to continue to use the procedure in most cases. Whether a good result from gastro-enterostomy may be expected before the ulcer has produced obstruction, has been widely discussed. At one time it was thought best to produce an obstruction by pyloric exclusion in cases in which the pylorus or duodenum was not obstructed. It was often said that a gastro-enterostomy would not functionate properly if the pylorus was open. This statement is seldom heard now, and, so far as I know, pyloric occlusion has practically been abandoned as an unnecessary procedure. Undoubtedly, there is a certain amount of true mechanical obstruction, or at least spasmodic obstruction, produced by most ulcers, and I believe that we have over-emphasized the importance of this phenomenon in obtaining good results.

In spite of generally good results from this type of operation there are certain cases in which it seems well to excise the ulcer in preference to making a gastro-enterostomy. It is this group of cases which I shall discuss particularly at this time. While we have performed several different types of plastic operations on the pylorus, in the cases in this group operation was not performed on the pylorus or stomach.

Roeder has recently reported an operation similar to the one I shall describe, although the indications for the operation and the technic are somewhat different. Finsterer reported a series of thirty-five cases of severely bleeding ulcers of the duodenum in which operation was performed while the hemorrhage was severest. Finsterer believes that it is better to remove the ulcer at this stage than to postpone removal until the severe anemia is overcome, as has been the custom recently.

Nowak, assistant in von Eiselsberg's Clinic, has reported a series of forty-seven cases of duodenal resection for ulcer of the duodenum. He believes that resection is applicable in the great majority

of cases, but says that the indication for the operation should depend on the general condition of the patient and on the proximity of the common and pancreatic ducts. He believes that with good technic the danger and mortality from the operation are scarcely greater than with other indirect methods. This operation is much more radical than the one I have performed.

The excision of the duodenal ulcer or ulcers and the reconstruction of the duodenum are accomplished as simply as possible. The symptoms of which the patient complains are the result of these ulcerations, and to obliterate them it is only necessary to remove the lesion. This is the fundamental principle of the operation; it does not change the physiology of the stomach. If, owing to the lesion in the duodenum, such change has occurred, then the organ should return to normal by the removal of the lesion. The question has been asked, "What will prevent other ulcers from forming?" A better knowledge of the cause of the original ulcer is necessary in order to answer this question. All foci of infection should be cleared up. If the ulcer has formed as a result of infection, the source of trouble will have been eliminated. I am not making a plea for excision of the ulcer; on the contrary, I am convinced that the operation has its limitations. Quite as good results will be obtained in selected cases as can be secured by any form of pyloroplasty or by gastro-enterostomy, and with a little less risk to the patient. The normal anatomic and physiologic relationship of the stomach, duodenum, and jejunum will be preserved.

The excision of the ulcer is particularly indicated if the entire ulcer can be excised and the duodenal lumen maintained, and if the entire operation can be performed more easily than gastro-enterostomy. If the ulcer is of the type that bleeds during an attack, excision is preferable. If localized pain is one of the chief symptoms and dyspepsia is slight or absent, I believe it

is better to excise the ulcer if it can be done readily. If the gastric acids are not high, and especially if the patient has a tendency to neurasthenia, it is best to excise the ulcer rather than to perform gastro-enterostomy.

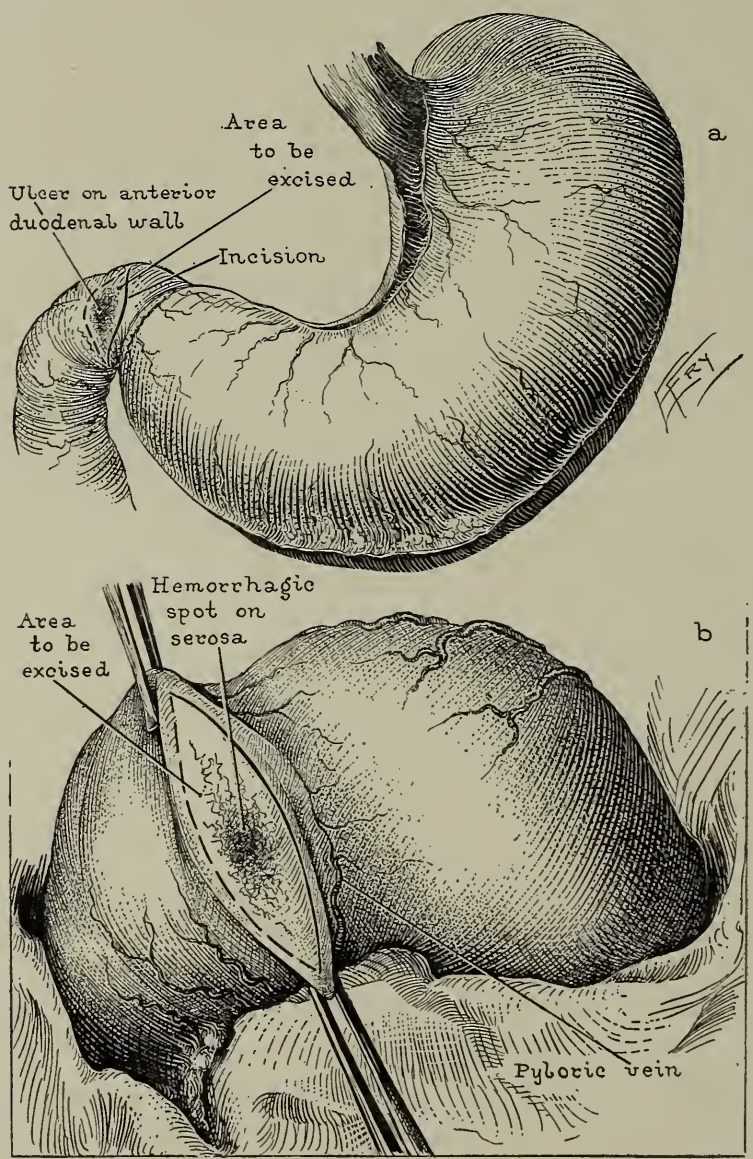

Fig 1. a. Position of incision in duodenum. b. Duodenum held by stomach clickers to facilitate making of incision.

Ulcers of the duodenum should not be excised unless the technical steps of the operation can be performed satisfactorily. This will be possible only if the duo-

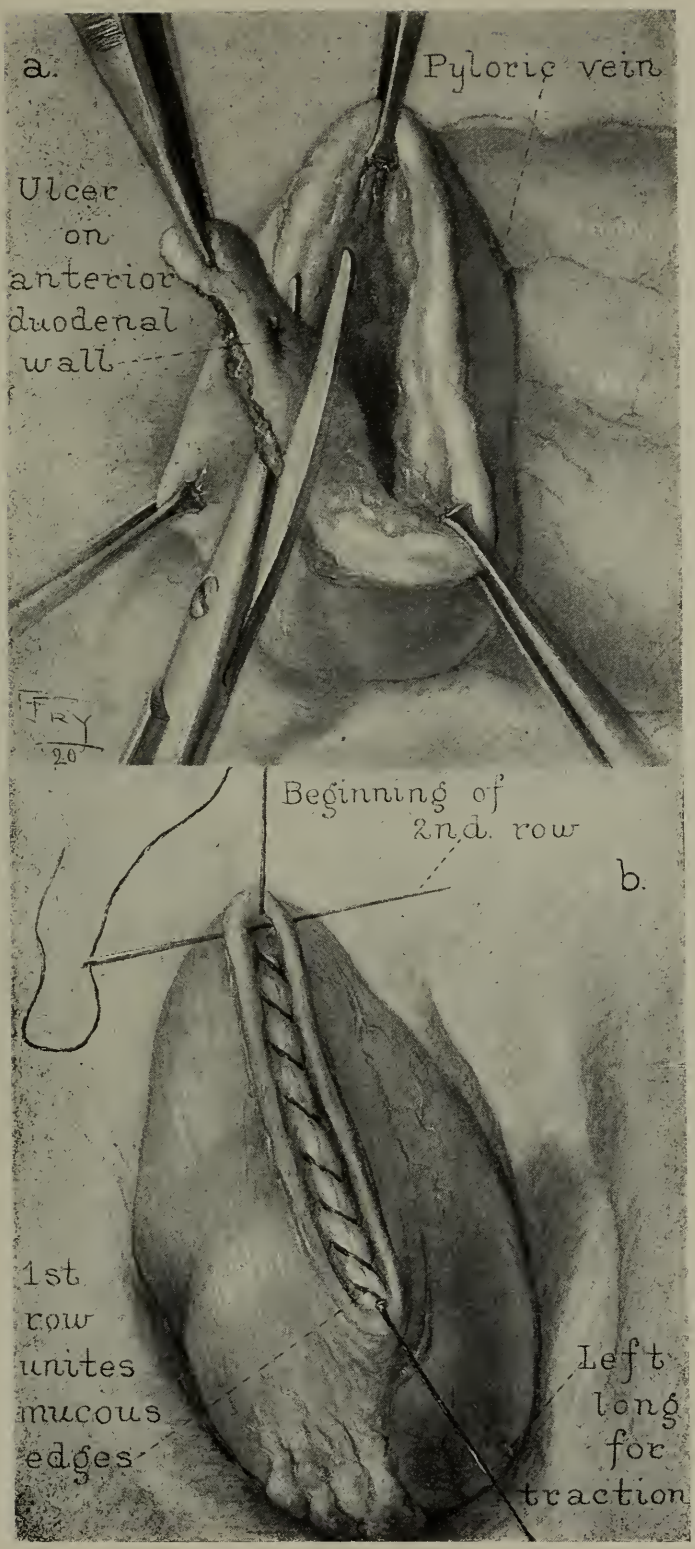

Fig 2. a. Excising ulcer on anterior duodenal wall. b. Mucous coat sutured with catgut.

denum is mobile or easily mobilized. It is true that, if the duodenal lumen is interfered with, gastrojejunostomy may be made; on the other hand, if it is necessary to make a gastrojejunostomy, it is ordinarily not necessary to remove the duodenal ulcer; therefor the gastrojejunostomy should be performed primarily.

In the operation which I am describing the ulcer is excised without attempting to enlarge the pylorus. We have had satisfactory results from the Finney pyloroplasty and also from the Heinecke-Mikulicz operation, but our present technic is more easily carried out than the others and, we believe, affords better opportunity to remove all of the ulcerated tissue. This operation is based on the belief that the ulcer is the cause of the symptoms and that its removal will be all that is necessary for complete relief.

TECHNIC OF OPERATION

The incision into the duodenum is made transversely on a line parallel with the ring fibers of the pylorus (Fig. 1). The upper transverse incision is usually placed just below the pyloric muscle, and the lower one far enough below the ulcerated area to pass through good tissue. After the ulcerated area has been removed the entire surface of the mucous membrane of the duodenum and pyloric end of the stomach are exposed for inspection. We have been rather surprised to find multiple ulcers in a large number of cases. Contact ulcers are much more common than we had believed, and ulcers on the posterior wall some distance from the pylorus have been unexpectedly encountered in several instances. In some of the cases of multiple ulcers it has seemed best to cauterize and suture over the deep ulcers (Figs. 2 and 3), and finish with gastro-enterostomy. In most cases, however, we are able to destroy all of the ulcers and finish with a good duodenum. After suturing over the deep ulcers the opening on the anterior surface is closed by three layers of sutures (Fig. 4), thus the

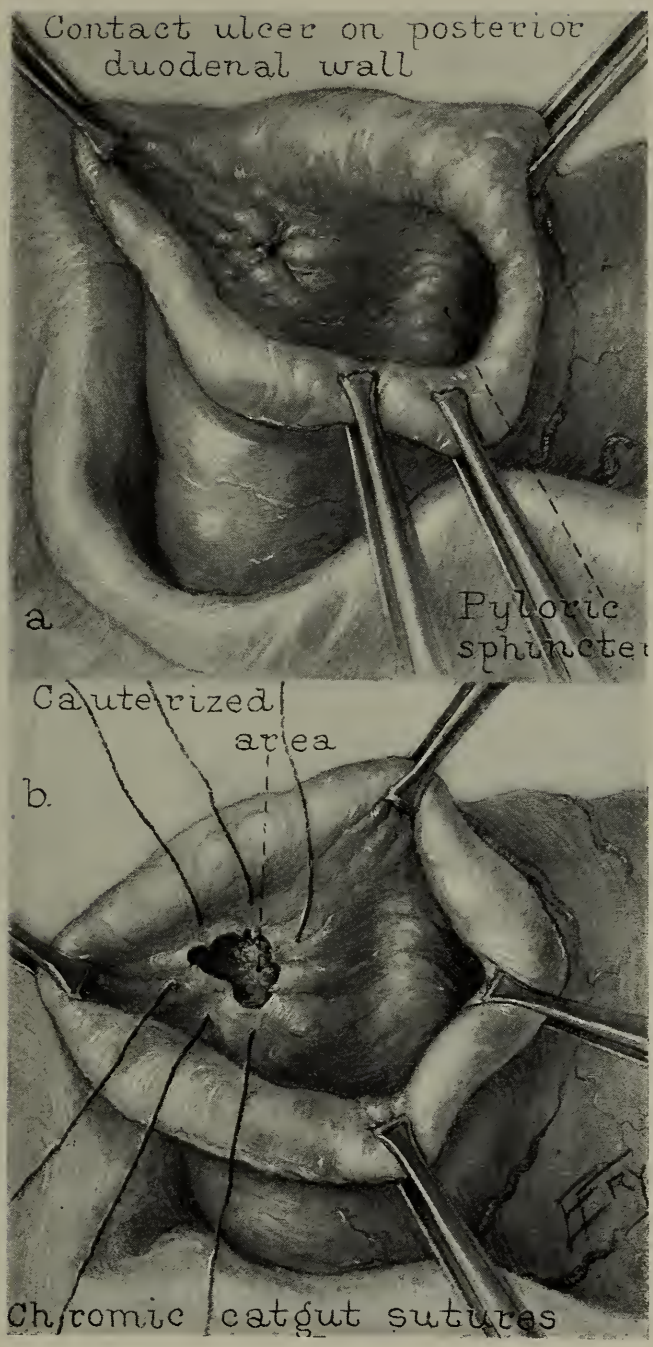

Fig. 3. a. Duodenum held open to expose contact ulcer. b. Cauterized area on posterior duodenal wall ready to be closed.

pyloric end of the stomach is sutured to the anterior surface of the duodenum, which almost amounts to a gastroduodenostomy. The entire duodenal cap is destroyed, so that a rontgenogram made after the operation reveals much the same deformity as that produced by the ulcer. This point must be kept in mind in making post-operative Röntgen-ray examinations.

RESULTS OF OPERATION

The operation has been performed in 141 cases in the Mayo Clinic with satisfactory results. The immediate results are very gratifying, and the convalescence is easier than after almost any other operation on the stomach. There is no vomiting, and apparently the stomach empties itself at once. In one or two cases there was some evidence of oozing, as shown by the tarry stools. This, however, was of no consequence. There was one death in the series; an elderly women developed pneumonia and died on the tenth day.

In most of the cases the functional result was very good. Gastric analyses were made a week or ten days after the operation in practically all of the cases, and repeated examinations were made in some. Following gastro-enterostomy, of course, the content of the stomach was not acid, and after excision of the ulcer there was a marked reduction in acid, although it was never entirely absent. In a few cases the acidity was not materially reduced. In most cases the acids were normal a few weeks after the operation.

In two cases I made gastro-enterostomies secondary to the excision of the ulcer. One of the patients had a new ulceration with a return of symptoms two years after the first operation; and one, a rather nervous girl, did not obtain complete relief. In this case I was unable to determine that there was any ulceration, and the lumen of the duodenum was apparently normal. In one case a gastro-enterostomy was performed else-

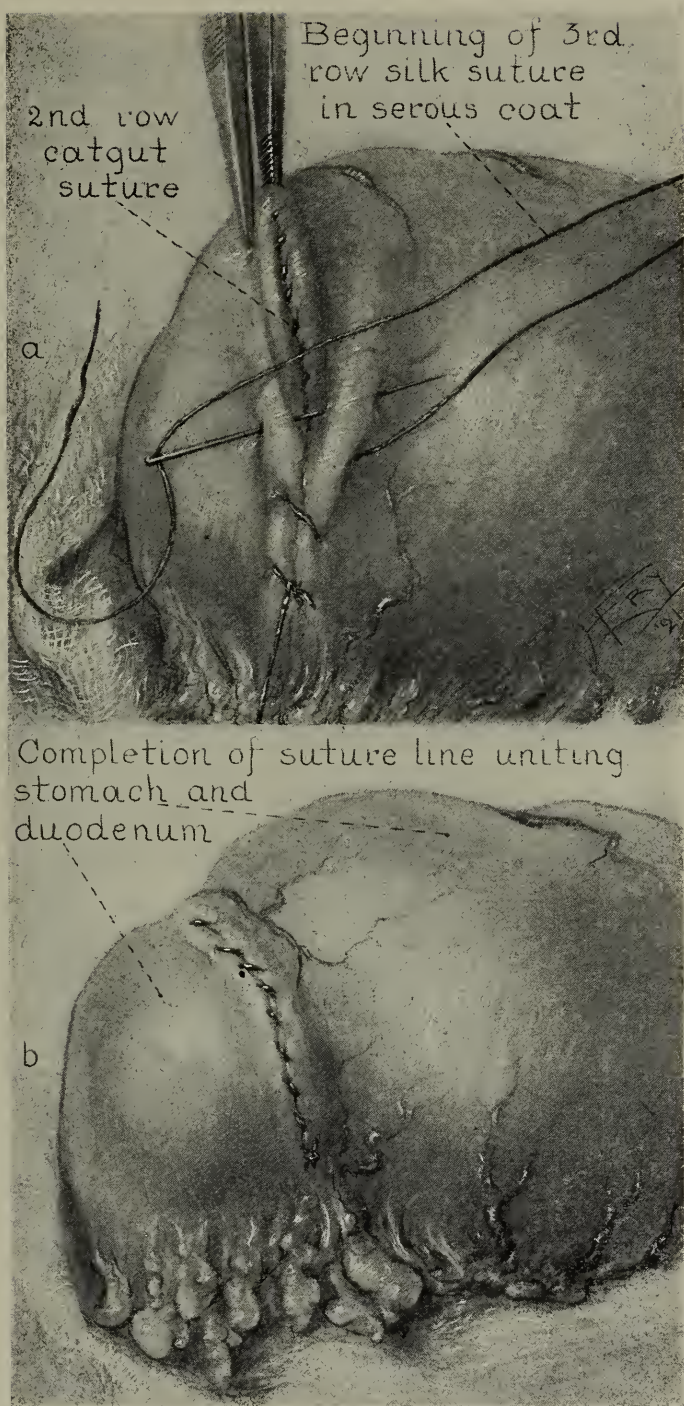

Fig. 4. a. Beginning of last suture. b. Suture completed.

where some months later, because the gastric acids had remained too high after the excision of the ulcer, and relief of symptoms was incomplete. The acids still remain high after the gastro-enterostomy.* An average of analyses of gastric contents in twenty-five cases showed before operation total acids 54 and free hydrochloric acid 41; eight days after operation it was total acids 34 and free hydrochloric acid 19. During this time these patients were on hospital diet.

COMMENT

I performed this operation a number of years ago in cases in which gastro-enterostomy had been unsatisfactory because of the formation of a jejunal ulcer. We soon learned that the best procedure in the jejunal ulcer cases is to undo the gastro-enterostomy and excise the original ulcer. The operation was so satisfactory in these cases that we employed it in others in which the indication seemed suitable. I am convinced that the excision of duodenal ulcer will never become general or take the place of gastro-enterostomy.

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*I am indebted to Dr. E. L. Tuohy, of Duluth, for the follow-up notes in this case.

ECTOPIC PREGNANCY

John L. Evans, M. D., F. A. C. S.

WICHITA, KANSAS

"Extra-uterine pregnancy" is a term which embraces all pregnancies occurring outside of the uterine cavity,—namely, tubal, including the interstitial type; tubo-ovarian; tubo-abdominal; ovarian and abdominal.

The large majority of these pregnancies are primarily tubal, and thus it is under the term "tubal pregnancy" that most extra-uterine gestations are considered.

The classifications of the cases may be said to be based on the symptoms and on the pathological findings.

Davies-Colley's classification is as follows:

1. Cases diagnosed either before or after primary rupture occurs with the ovum still developing.

2. Diagnosis at the time the rupture occurs. The so-called acute cases.

3. Diagnosis of tubal mole or tubal abortion. The subacute or chronic cases.

Dr. Mussey, of Rochester, Minn., reports 168 cases occurring at the Mayo Clinic from July 1, 1904, to July 1, 1914. One hundred of these cases were reviewed by Graham in 1910. In reporting the last 68 cases Mussey states that the greater number come in the third group, namely, the subacute or chronic.

Following are the figures: 19 unruptured cases; 19 ruptured with free blood in the peritoneal cavity, in many cases the blood being old with clots; 30 subacute and chronic cases. In the writer's opinion the reason

the chronic cases so outnumber the acute cases is due to the fact that the acute cases are unable to reach the clinic.

In this paper I expect to deal with the first and second classes,—that is, those cases diagnosed before rupture and those known as acute, diagnosed at the time of rupture.

Etiology: some low grade infection in the tube caused swelling of the mucous membrane or interference with the proper movement of the flagella of the epithelium lining the tube. Trouble outside of the tube, such as adhesions or tumor pressing on the tube, produce a kink or deformity of the tube.

Ectopic gestation was considered rare until 1883, when Lawson Tait first operated for this condition, but since that date we have learned that it is a frequent condition. Some authorities claim that it occurs in 4 per cent to 5 per cent of abdominal gynecological operations.

The average age of the patients in the 168 cases reported from the Mayo Clinic was 31½ years. The oldest patient was 45 years, and the youngest 15. Sixty-five had not had children, and 31 had only one child. The largest number was seven. The number of children in all average a little less than two to each mother. Four patients had previously been operated on for extra-uterine pregnancy.

Tubal pregnancies are classified, according to the site of the development of the ovum in the tube, into ampullar, isthmic, and interstitial pregnancy.

Ampullar is the most frequent, the pregnancy occurring in the outer third of the tube. This type is also less serious. Many times the ova will be aborted through the fimbriated end of the tube, very little hemorrhage and shock occurring, and, I believe, in many cases it is not diagnosed.

In isthmic pregnancy the ovum is arrested in any

portion of the tube between the ampulla and the horn of the uterus. When rupture occurs in this type it is usually accompained by severe pain, hemorrhage and shock. The nearer the rupture to the uterus the more severe the hemorrhage and shock.

It is very often possible to diagnose the location of the rupture from the condition of the patient.

Interstitial pregnancy is the rarest form of tubal gestation. Johnson states that there are less than one hundred cases reported in the literature.

Pregnancy may occur in both the uterus and the tube at the same time. Multiple pregnancy may occur in one tube, or there may be a pregnancy in each tube.

Seventeen cases of ectopic pregnancy have been under my care during the last twelve years. They all belong to the acute class with the exception of two or three, where the diagnosis was made before rupture occurred.

I have no record of the subacute or chronic cases that have been under my supervision.

The majority of the above cases were in patients between thirty and forty years of age. The youngest was twenty and the oldest forty-six years of age.

In three the rupture had occurred near the horn of the uterus; the remainder were of the ampullar type.

Many of the cases were in extreme shock, showing evidence of marked internal hemorrhage.

Three were complicated by gall-stones. In one of these the gall-stones were diagnosed before operation; the other two were found at operation. In each instance the gall-stones were removed at a subsequent operation. We did not consider it safe to subject the patient to the additional surgery necessary for removal of the stones at the primary operation. One case showed glycosuria, which cleared up promptly following the operation.

Many of the cases were seen by me soon after rupture occurred. With one exception they showed the most profound shock. Those from adjoining towns arrived at the hospital from six to forty-eight hours after rupture, and most of them had at least partially recovered from the shock.

The 17 patients were successfully operated on without a fatality, but in no instance was the operation performed until the patient had at least partially recovered from shock. They were operated on from twenty-four hours to ten days after their arrival at the hospital, the time for operation depending entirely upon the condition of the patient.

Dr. De Lee says that diagnosis of extra-uterine pregnancy is rarely made before rupture of the tube. Hirst, however, states that the majority of his cases were diagnosed before rupture. The acute cases are the easiest diagnosed. When called upon to examine a woman of child-bearing age who has missed one or two periods and who has a sudden, severe, tearing, one-sided, lower abdominal pain accompanied by collapse and is found pale and weak, with a small pulse, sighing respiration, thirsty and faint, the abdomen somewhat rigid, many times a subnormal temperature and a slight leucocytosis, pelvic examination may show a slight change in the color of the mucous membrane and softening of the cervix, a mass may or may not be felt to one side of the uterus,—the above described condition and symptoms being present a correct diagnosis can usually be made.

Many times we have patients stating that their period was delayed for two to six weeks, and then they began to flow slightly, and this flow has continued for a period of two to four weeks. These cases should be carefully examined with the idea in mind of a possible tubal pregnancy. They are most often mistaken for a miscarriage and are sometimes curetted. Three of the patients in my series had been curetted before they came under my care.

The pain may be misleading; it may be in the upper abdomen and occasionally resembles gall-stone colic. The pain was referred to the region of the gall-bladder and under the right shoulder blade in two of my cases. In both instances I found the left tube to be the seat of trouble. In one case the pain was so severe that the patient would cry out for someone to make pressure over the right upper quadrant of the abdomen when a paroxysm occurred.

Treatment: The treatment is surgical. If the diagnosis is made before rupture has occurred, operation should be performed at once. There is diversity of opinion and practice among surgeons after rupture. A few take the stand that all cases should be operated on at once without regard to the condition of the patient. They contend that the danger is from hemorrhage, and that where bleeding is going on the surgeon should interfere at once.

Statistics show that the mortality among patients operated on during the acute depression incident to hemorrhage and shock, is about 50 per cent, and that among patients operated on after recovery from shock is less than 5 per cent. About 5 per cent of patients following rupture will die from shock and hemorrhage, and I believe in most of the cases death occurs before an operation can be performed.

It is obvious that not to operate at all gives the patient a better chance for life than to operate during the stage of acute depression.

In all my surgical work I make it a rule not to operate in the presence of shock.

A number of the above reported cases were in a very critical condition when seen by me. A few were kept alive with the greatest difficulty.

While transfusion was not resorted to in any of these cases, I believe it would be of great value and should be used if a suitable donor is at hand.

Our cases were treated by marked elevation of the foot of the bed. The application of external heat, hypodermoclysis of normal saline, soda bicarbonate, and glucose per rectum, the subcutaneous injection of normal serum are also indicated. Some men recommend the placing of sand-bags over the abdomen, claiming that the pressure they exert will limit the hemorrhage. When reaction has occurred and the pulse rate and volume become fair, operation should be done. Ether or gas-oxygen anesthetic should be used.

The incision should be made in the mid-line between the umbilicus and the pubes. Many times the blood will gush from the abdomen when the peritoneum is incised. The fundus of the uterus should be caught with a tenaculum and pulled up into the wound, the ruptured tube located and clamped. The clots should be gently removed from the abdominal cavity by means of moist sponges. I do not think it necessary to irrigate the abdominal cavity in this condition. Some men claim that it is possible and good surgery to remove the clots from the ruptured tube and to stitch up the rent leaving the tube; however, I believe most surgeons do a salpingectomy.

I do not believe it good practice to remove the other tube unless it shows unmistakable evidence of disease.

I have never reoperated on a case for tubal pregnancy. As stated above, 4 of the 168 cases reported from the Mayo Clinic had had a previous operation for this condition.

Drainage is not necessary. The patient should be placed in the semi-Fowler position unless evidence of shock is present when the operation is completed. The after-treatment does not differ from that employed following any laparotomy.

DISCUSSION

Dr. William T. Reynolds: (Kansas City, Mo.): I do not know whether I understood Dr. Evans correctly or not, when

he said the fundus of the uterus should be grasped with a tenaculum and pulled up. I think such a procedure is liable to result in a tragedy, even in the hands of a rapid operator. The cases of ectopic pregnancy that are safely operable are those in which clot-formation has followed the primary hemorrhage. If you pull the uterus up, you are likely to start a quick, rapid hemorrhage, which can be obviated by slipping your hand down by the side of the uterus, outlining the tube, and clamping it off.

If I may be permitted to call attention to one thing, I would like to say that there is a possibility of pregnancy taking place in a woman who has had her tubes removed, unless they have been taken out clean up to the junction of the uterus. Four or five months ago, Dr. Ayres of Kansas City, asked me to see a woman with all the cardinal symptoms of tubal pregnancy. He so diagnosed the case. After the diagnosis was made the patient said it could not be the case as she had had her tubes removed. In removing the tubes the surgeon had left a little portion of the left tube, where pregnancy had taken place. This case emphasizes the point that in the removal of the tubes one should be careful. Make the excision at the uterine junction. I believe in all cases of ruptured tubal pregnancy that it is always the safer plan to put in a drain.

Dr. Warren A. Dennis: (St. Paul, Minn.): In connection with what Dr. Reynolds has said, I should like to mention an experience I had a number of years ago. I operated on a woman for tubal abortion and left about three-quarters of an inch of the tube. Three months later she had ectopic pregnancy in the stump of that tube and almost bled to death.

Dr. Horatio B. Sweetser (Minneapolis, Minn.): I think the important point in this paper is whether we shall wait until the patient recovers from shock or not. I think the essayist is wrong when he said he would wait until shock was recovered from. This is shock from hemorrhage. The only case I have lost was where I delayed operation. I saw a patient in the afternoon and thought she was moribund. She came to the hospital and by midnight she had recovered. Her pulse was not rapid. We thought we could wait until morning. About 4 o'clock in the morning (a nurse was in the room all the time) she suddenly developed a terrific pain and died. I went to the hospital and operated on her immediately, but she died on the table. We had no blood-transfusion ready. We gave her transfusion of salt solution, but she died.

We had another patient that we watched, not voluntarily on my part, but because, first, her father refused to have her

operated on, and, later, when he consented, she herself refused. I stayed in the hospital all the time, and I could watch her pulse go up until it was almost obliterated. Under local anesthesia, without any increase in the shock at all, I opened the abdomen, put a clamp on the actively bleeding vessel, took out the ruptured tube, did not disturb the blood in the abdomen at all, and closed the wound. She recovered. To have waited for such a patient to recover from shock before operation, I am sure, would have resulted in a fatality.

Concerning the removal of both tubes at operation for extra-uterine pregnancy: I do not think it advisable for the reasons that (1) a subsequent ectopic seldom occurs on the other side, and (2) a number of cases have been recorded in which children have been born following operation for one extra-uterine gestation. I recall one patient we operated on who subsequently was delivered of a living healthy child. About four years later I removed an ectopic gestation from the other side with recovery.

Dr. Roger T. Vaughan (Chicago, Ill.): Regarding shock in ectopic pregnancy: I presume the essayist can only mean cases of ruptured ectopic pregnancy. I agree with the preceding speaker in that in such cases where we have symptoms of so-called shock I consider those symptoms indicative rather of internal hemorrhage. If one should let such a case go unoperated on and treat the patient for shock with intravenous saline transfusion, what becomes of the salt solution? It simply runs out through the bleeding pelvic vessel, and "shock" is not overcome, but the patient's condition becomes, on the contrary, progressively worse.

In cases that have come to me, as soon as I can make a diagnosis of ectopic pregnancy or, more frequently, of acute surgical abdomen with a suspicion of ectopic pregnancy, I start the patient at once for the operating-room, irrespective of the pulse or blood pressure, and begin having the arm prepared for intravenous saline solution at the same time my intern is preparing the abdomen. Then I open the abdomen rapidly, grasp the big and bleeding tube, guided to it by touch, not by sight, and carry out the rest of the procedure at relative leisure, since the patient's condition is improving continually as the transfusion proceeds.

The symptoms of shock are so like those of hemorrhage that when hemorrhage is obviously present, as in ruptured ectopics, it seems to me unsurgical to call these symptoms shock rather than internal hemorrhage.

When gunshot wounds of the abdomen likewise are treated in an expectant way for "shock" the saline solution simply runs out through the torn abdominal vessels about as fast as

administered, and the patient's condition becomes, not better, but progressively worse.

I have not yet lost such a case of ruptured ectopic pregnancy. I may as I become older and have more experience, but I have had, at least, a dozen such cases and have not yet lost a patient either on the table or after operation. That may be luck, but, at least, I can say I have not yet seen unfavorable results from treating these patients as cases of internal hemorrhage rather than shock.

Dr. Byron B. Davis (Omaha, Neb.): It seems that to preach the doctrine of waiting for these cases to rally from shock is a dangerous thing. A patient one Sunday was brought to one of our hospitals, and the doctor in charge telephoned he had a case of ruptured tubal pregnancy and wanted the woman operated on right away. The patient was almost pulseless when I reached the hospital. It looked as if she was bleeding to death. If I had hesitated for an hour waiting for that patient to recover from shock I would have lost her. I opened her abdomen quickly and scooped out the blood so that I could see and grasp an artery that was spurting, I could count the heart beats by watching the spurting blood, but the operation was done quickly, we had normal salt solution given, and she made a recovery.

If the doctrine preached in this paper had been followed in that case, the patient would have died, and others that might be cited would certainly have died if the operation had been delayed to await recovery from shock.

Dr. Aubrey H. Williams (Denver, Colo.): With reference to the matter of drainage in these cases, it must depend upon the conditions present. I saw a patient who had only been married a few months and in her case I made a diagnosis of tubal pregnancy. I inquired at the hospital if the husband had had gonorrhea, and he said he had not. I gave a prognosis of twelve days in bed. When I operated I not only found tubal pregnancy involving the right tube and filling the cul-de-sac, but I found pyosalpinx on the left side and an abscess lying between the two tubes. In that case I drained, and the patient was on her feet in twelve days.

We all agree, I think, that there is urgency for going into these cases at once. I lost one case of ruptured tubal pregnancy twelve years ago. In this case we used too much salt solution in the vein, and I paid very little attention to what the assistant was doing in giving the salt solution. Later on I found I had water-logged the patient's lungs. With the exception of that one case, I have not lost a patient by going in at once. I lost one patient in the acute stage immediately following a rupture within twenty-four hours by procrastina-

tion. However, there is another feature to this which I had hoped one of the speakers would bring out. This is such an important thing in reference to this one paper that it ought to be mentioned.

Those of you who are doing your work in certain sectarian institutions know full well that recently a certain association of hospitals has adopted definite rules in which they say certain kinds of work shall not be performed in their institutions, and among the class of work is tubal pregnancy; that a case of tubal pregnancy must not be interfered with at any time prior to its rupture. After the tube has ruptured you are permitted to go in, but you must preserve the integrity of the tube. To me that is something which I cannot conform to and which I will not conform to. The institution where I do my work, the Mercy Hospital, Denver, is one which is governed by this association of hospitals and in which the rules have been published and printed and decorate the walls of the doctors' dressing-rooms. The first time I have a case in which I am able to make a diagnosis of tubal pregnancy, I suppose, if the patient is in proper condition, I shall take the tube out and see what they have to say. If these rules are going to be enforced, bodies of medical men, especially surgeons, should take cognizance of it.

Dr. Willard D. Haines (Cincinnati, Ohio): I should like to accentuate one point relative to the time to operate upon these cases of ectopic pregnancy: The time to operate is when the diagnosis is made. I take it that when you have a hemorrhage from the femoral vessel or radial artery you will not indulge in careful waiting. Not at all. You cannot sleep until you control the hemorrhage, and I see no reason why ectopic pregnancy should be any exception to the general rule governing control of hemorrhage.

The essayist spoke of interval cases. There is a difference between an acute abdominal condition and one where you are operating in the interval. He makes them all safe cases. He has lost a number of patients. Usually we do not get reports of the ones that are lost except in hospitals. I do not think we can support the position that if a patient is bleeding we should wait until the bleeding ceases before resorting to interference. If bleeding has ceased spontaneously the hematoma may be taken care of by the peritoneum in the absence of infection. I question the advisability of removing the clot at operation, as the peritoneum will absorb it, and it will prove to be a valuable ally in the recovery of the patient.

Dr. Charles D. Lockwood (Pasadena, Calif.): Several years ago I called attention to a very important measure which, I think, might be employed in cases of extra-uterine pregnancy, and two lives were saved by it. I refer to auto-

transfusion. We had a case in which I did a splenectomy at the Los Angeles County Hospital, the patient having had a severe hemorrhage. We removed blood from the cavity by the basinful, defibrinated it, citrated it, and reintroduced it into the patient's veins with marked improvement. I had never done that in a case of extra-uterine pregnancy, but did it in a second case of splenectomy. In going over the literature I found reports of nine cases where this had been done. You can scoop out a basinful of clots, be prepared to have it defibrinated, citrated, and immediately reintroduce it into the veins, and you have all the benefits of transfusion. I thought at the time it was original with me, but when I looked up the literature I found in *Surgery, Gynecology and Obstetrics* that nine cases had been reported where this had been done in Germany. Where you have not the facilities for immediate transfusion, this measure is worth considering in the desperate cases.

Dr. Evans (closing): I wish to thank the gentlemen for their free discussion of my paper.

The suggestion made by Dr. Reynolds in regard to using the hand to control hemorrhage is a good one. My principal object in putting a clamp on top of the uterus is more for orientation than it is for pulling the uterus up into position. By locating your anatomy and making general traction you can place the clamp on to better advantage, because many times the pelvis is full of black blood. It has not been my experience to have found bright blood in these abdominal cases, and I have operated on some of them twenty-four hours after rupture. The black blood covers up the field, and great difficulty occurs in deciding from which side the hemorrhage occurred.

Dr. Sweetser mentioned a case that he lost from waiting. I think the trouble with the doctor was that he operated during shock. He should have waited until the patient had recovered from the second hemorrhage. After the second hemorrhage it was a better plan to have waited until she had recovered from it. I have had no deaths before operation and no deaths following operation. There has not been a single case I have lost by not operating. Many of the others I would have lost if I had operated at the time they were admitted to the hospital.

I was called to the southern part of my town to see a patient who had a ruptured ectopic pregnancy, and I recognized the condition as soon as I saw her. An ambulance was called; she was rushed to the hospital a distance of not more than a mile and a half; and at the time she arrived at the hospital she was in such a condition that it seemed impossible to attempt a surgical procedure under local anesthesia or any

other method. She was in bed with her head down and body elevated at an angle of 45 degrees to keep her alive. When she was transferred from the ambulance stretcher to the bed it looked as if she had expired. Any surgical procedure, local or otherwise, with the woman in that condition, would have terminated fatally.

Dr. Haines: Why did you not operate on her at the house at the time instead of having her taken to the hospital?

Dr. Evans: I do not think anything would have been gained by that.

In regard to transfusion, it is said that if you put blood into the vein it will run out through the open vessel. Perhaps that is true. I do not advise overstimulation. The only stimulation which in my opinion should be used is stimulation sufficient to keep the patient alive. You can overstimulate if you raise the blood pressure too high, and you will have a new hemorrhage and do the patient injury. You will get absorption enough from the subcutaneous salt solution to keep up the blood pressure. If you put the salt solution in the vein it is liable to run out through the open vessel. If you put it under the skin absorption takes place slowly, but sufficiently fast to keep the patient alive. I think it is better to use the salt solution subcutaneously rather than intravenously until you clamp the vessel. Some of these patients were so desperate that to attempt any surgical procedure would have been fatal and none of them died from the way in which I handled them.

Dr. Arthur T. Mann (Minneapolis, Minn.): This is a responsible body of surgeons who have had a great deal of experience, and when we met fourteen years ago this same question came up, and it was left open.

I would like to have the President call for some expression of opinion from this body on this point, and I would like to know how many men who have had real experience will agree that the procedure of waiting in cases of active bleeding is the correct one.

Dr. Sweetser: I take it the assumption of the essayist is that when he saw the patient the hemorrhage had stopped; but Dr. Davis mentioned a case in which when the abdomen was opened the artery was still pumping. How can one tell that the bleeding has stopped or that it will not suddenly recur?

The President: You cannot always know when the hemorrhage has stopped.

Dr. Evans: These cases were operated on from twenty-four hours to ten days after rupture, and in no instance did

I see bright-red blood in the abdominal cavity, and it is my opinion the hemorrhage had stopped in these cases before any operative procedure could be undertaken. I feel from my observation of these cases that hemorrhage stops when the blood pressure gets down to almost nil. In the case mentioned by Dr. Davis the opening of the abdomen might have been sufficient to dislodge the blood-clot. If we knew an artery was pumping in the abdominal cavity and there was any chance of entering the abdominal cavity and putting a clamp on that blood vessel, I take it that there is no one here but what would attempt to do it. But I feel when the blood pressure gets down to almost nil the bleeding has ceased. In fact, only 5 per cent of the patients bleed to death, and they die before any surgeon could interfere.

Dr. Lockwood: We used to have a good deal of discussion in connection with appendicitis as to whether we should operate at once, or whether we should wait and pursue the Ochsner treatment. I remember at one meeting of this Association Dr. Van Buren Knott took the position that we should operate in every case as soon as possible and always remove the appendix. I believe most men have now come to that conclusion, and to clear the atmosphere in reference to operating on cases of ectopic pregnancy I would suggest that the members express their opinions on the main proposition.

Dr. Donald Macrae (Council Bluffs, Iowa): In regard to the cases the doctor speaks of: I think it would be folly not to operate. The point the doctor brings up is that we should not operate in the midst of active hemorrhage where there is shock. That is a great mistake, and his figures of 50 per cent are not in accord with my experience. We have not had a single death, and many times I have operated on patients in extremis. I do not think there is so much in the personal equation of the operator as the location of the hemorrhage. It might be well to wait in some of these cases of ectopic pregnancy until we have the patients in a hospital. After bleeding, if they have any kind of pulse, you can usually get them off the table alive. Leave it to nature. If the bleeding stops they get well. I had a patient six weeks ago who died while I was in the room consulting for a few minutes. She was not sick two hours from the time I was first called until I got there. If we feel in such cases that the hemorrhage has ceased and the patient is in extremis and has a chance to rally, I would not operate. But in every case where there is an active hemorrhage and the patient has any kind of pulse I would operate and put a clamp on the bleeding vessel, which can be done in a few minutes.

Dr. Mann: If I understood the essayist rightly, his proposition is that in cases of ruptured extra-uterine pregnancy during active bleeding, while the patient shows the

effects of what he called shock from the bleeding, to wait. That is the point. I agree absolutely with what Dr. Macrae has just said, but in the remarks of the essayist it was not put in that form.

Dr. Jabez N. Jackson (Kansas City, Mo.): My friend from Kansas (Dr. Evans) did not say anything about the existence of actual hemorrhage. He stated that in cases of profound shock a patient usually does not have shock without hemorrhage. I know they do. They have a profound shock with a small amount of blood entering the peritoneal cavity.

I operated on one patient when I should not have done so, and lost her. Two years ago in a certain neighborhood near Kansas City a woman had extra-uterine pregnancy in which rupture had taken place and was accompanied with shock. Two doctors saw her, one of whom said that Dr. So-and-so has operated on many hundreds of these cases and has never lost one. The other physician said, let us call Jackson, he has a good reputation. and the woman is going to die anyway. To make a long story short, the woman was brought to the hospital in a moribund condition. She was without any color, and I could not detect any pulse, and I said I would not operate on her in that condition. In twenty-four hours, with rest and elevation of the foot of the bed, the pulse became practically normal. I then operated on her, and she made a good convalescence and recovery. So the proposition stated by Dr. Evans is substantially and conservatively correct, and I have done as he has done in these cases with spurting artery.

Dr. Mann: After what has been said, I think we are all in closer contact than I thought we were, but, if Dr. Evans had stated his exact position, we would know where we stand.

Dr. Evans (closing): I wish to thank Dr. Jackson for helping me out. It seems I got into deep water, but my contention is not to operate in the presence of extreme shock, where the patient is pulseless, where you have to exert all your efforts to keep her alive. I have seen these patients in that condition, and know that if I had attempted to do any surgery on them they would have died. If I should get a case early enough and the patient had not reached that stage of shock, if she were going into a stage of shock from hemorrhage, I would try to prevent that hemorrhage. I would go in if the volume of the pulse were fair and take a reasonable risk. But my contention is not to operate in the hopeless cases. I feel that some of the patients will rally sufficiently to make them safe risks; and, as Dr. Jackson mentioned, many times the shock is not the result of extreme hemorrhage. I have operated on patients that were in extreme shock, and they have gotten out of the shock; and I have found possibly

half a pint of blood clots in the abdominal cavity, but the woman could have bled four times that much and not have any shock. It is due to the rupture of some intra-abdominal viscus. It is not from hemorrhage. I have seen other cases where the blood would gush from the abdominal cavity as soon as the peritoneum was incised, but it was all dark blood, not an active hemorrhage.

Dr. Haines stated that a blood clot in the abdominal cavity would not produce trouble. In many instances that may be true, but you may have a partial rupture and a second hemorrhage, so that it is well to remove the tube together with the clot. I hope you gentlemen understand me now.

With reference to the remarks of Dr. Mann, I will say that if I had a case of spurting artery in the abdominal cavity or any place on the human body and I thought the patient had a chance of withstanding my efforts in getting hold of that vessel, I would clamp it as readily as any man here.

Dr. Mann: I am satisfied now.

PAPILLARY CYSTADENOMA OF THE MALE BREAST

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The occurrence of tumors in the male breast is relatively uncommon. Of 242 cases of breast tumor collected by Roger Williams,[1] only 25, or 1 per cent, occurred in the male breast. Gebele[2] reported 359 consecutive breast tumors from Angerer's clinic, of which not one occurred in the male breast. Of the 25 cases reported by Williams, 16 were carcinoma, 3 were sarcoma, 2 were myxoma, and 1 each were adenoma, lipoma, angioma, and cystoma. The rarity of benign tumors of the male breast is emphasized by these statistics. Schuchardt[3] collected nearly 500 tumors of the male breast from the literature, the largest percentage of which were carcinoma. He collected instances of nearly all of the benign tumors of the breast including five papillary cystadenomas.

The cystic feature of a large proportion of benign tumors of the breast is well known. Bloodgood,[4] in a recent well-illustrated article, has classed all cystic tumors of the breast chronic cystic mastitis and has demonstrated adenomatous, cystic and inflammatory features in practically all of the varieties. Even the papillary structure of the epithelium is occasionally, and in some instances frequently, found in the different types of cysts.

Probably the most commonly seen cysts are the large ones which are slow-growing and usually appear before the menopause. They are smooth-walled, contain clear or cloudy fluid (blue dome cyst—Blood-

good.) or contain a milky fluid (galactocele). They occur in breasts undergoing adenomatous and, not infrequently, inflammatory changes.

Diffuse cystic mastitis, often affecting both breasts and associated with multiple, small cystadenomas and inflammatory reaction in the stroma, is a much discussed lesion, not only in an attempt to accurately catalogue it pathologically, but also to ascertain its tendency to malignant degeneration. Astley Cooper, Reclus,[5] Schimmelbusch,[6] König,[7] Saar,[8] Warren,[9] and Bloodgood[10] have especially contributed to our knowledge of the pathology and clinical picture of the disease. This condition, often referred to as Reclus disease, Schimmelbusch disease, chronic cystic mastitis, or senile parenchymatous hypertrophy, is regarded, respectively, as a cystadenoma, an inflammation with cyst formation, or a hypertrophy of the epithelium of the acini with cyst formation. Papillary outgrowths in the cysts are frequently described and regarded as an inclincation to malignant degeneration, which actually occurs in about 10 per cent of the cases.

Another relatively common cyst in the breast is the duct cyst or duct papillary cyst adenoma, which may be single or multiple; it involves the large ducts of the breast and is usually situated under the nipple. Greenough and Simmons,[11] Deaver and McFarland,[12] Bloodgood, Judd[26] and Lewis have given splendid descriptions of this lesion. Greenough and Simmons have reported twenty cases from the records of the Massachusetts General Hospital and Deaver has collected forty cases from the literature. As it is this type of tumor which serves as the subject of the report, a summary of its chief characteristics will be given.

INCIDENCE OF AGE.

Thirty-five per cent of the cases were in patients under 50 years of age and 30 per cent were between

50 and 70. The youngest patient was nineteen and the oldest eighty-one.

INCIDENCE OF SEX.

This tumor is essentially one of the female breast. In a fairly comprehensive search through the literature, only eleven cases have been discovered in which the tumor was present in the male breast. A few others are described in which carcinoma of the male breast probably resulted from a malignant degeneration of a papillary cyst adenoma of the male breast.

LOCATION OF THE TUMOR.

The tumor is usually under the nipple or near it. It is seldom bilateral. It rarely projects above the surface of the skin. It is well circumscribed and not attached to the skin or pectoral fascia except in very old neglected cases, where the skin may be adherent to the tumor and undergo color changes incident to interference with circulation. Six of the thirty cases reported by Greenough and Simmons had the skin over the tumor adherent to it. The nipple may be somewhat retracted when the tumor is under it.

THE SIZE OF THE TUMOR.

The size of the tumor depends somewhat upon the length of time it has been present but usually varies from a small nodule to the size of one's fist. The average size is about that of an English walnut. Rarely the cyst may rupture externally and present a fungoid cauliflower appearance which has been described as pseudosarcoma phyllodes (Müller).

The duration of the tumor in the described cases has been about two years.

Axillary glands are usually not enlarged, though Greenough and Simmons report two cases with enlarged axillary glands which were probably on an inflammatory basis.

SYMPTOMS.

The most characteristic symtom, in addition to the slowly growing tumor under the nipple, is a discharge from the nipple, which is present in about 75 per cent. of the cases. The discharge is usually milky but may be bloody. Deaver states that 25 per cent. of the cases have a bloody discharge.

Pain may be present and is usually in the region of the tumor. It is not a prominent symptom and is present in only about one-third of the cases.

PATHOLOGY.

In addition to the gross appearance of the tumor already described, on cross section the tumor consists of one or more cysts containing blood stained fluid. The whole cavity of the cyst may be filled with red friable tissue which is papillary epithelial growth. More commonly only one part of the wall of the cyst has undergone papillary proliferation while some of the smaller cysts may have no papillary outgrowths from the cyst wall. These papillary structures may have a pedunculated or a sessile attachment to the wall of the cyst. In the latter instance they appear somewhat like sago, being rounded and of dull color, while in the former they consist of waving, finely divided, arborescent epithelial processes. Where the cavity of the cyst has been filled by the papillary outgrowth, the cross section of the tumor may appear more like a solid tumor with a soft friable blood-center.

Microscopically the wall of the cyst is lined by a columnar or cuboidal epithelium, unless the cyst is quite old, where the epithelial lining may be absent except over the papillary outgrowths. The papillary processes usually have a branched connective tissue stalk in which are small blood vessels. When they are sessile and have a wide basal attachment on the cyst wall, the cyst can be distorted by their growth with the result that many branching clefts are formed and in the end cauliflower or leaf-like structures re-

sult that have been named pseudosarcoma phyllodes (Sarr[8]).

The fine arborescent papillary growths undergo degeneration and necrosis and bleeding takes place into the cyst.

The connective tissue stroma surrounding these cysts is often overgrown and rich in nuclei. Hyalin degeneration is seen in some areas and foci of round cell infiltration are common.

After local surgical removal of these papillary cystadenomata of the ducts, recurrence may take place. Greenough and Simmons report two recurrences in ten cases where local removal was done. One of these recurrences was reoperated upon and the tumor was found to be of the same structure as the original tumor. The other recurrence was not reoperated upon but the recurrence did not appear malignant.

Ziegler and Kaufmann both speak of the tendency of these papillary tumors to undergo malignant degeneration. Tietze[13] thinks 10 per cent. undergo malignant degeneration. In Greenough and Simmons cases, 15 per cent. had undergone malignant degeneration.

TREATMENT.

In view of the tendency to malignant degeneration shown by these tumors and of their tendency to recur after local removal, it is the prevailing opinion that they should be treated by removal of the breast.

CASE REPORT

The case to be reported occurring in a male breast is unusual in addition to the sex of the patient from the standpoint of the patient's age, the duration of the tumor, its recurrence after local removal as well as its appearance after eleven years' growth.

Case 1.—A male, 82 years of age, was admitted to my service in the Cook County Hospital in August 1921. Considering his age, his general condition was good. Fifteen years ago he noticed a small lump under the left nipple and

shortly after this, a milk-like discharge from the nipple began which persisted until local removal of the tumor and nipple three years after its first appearance. About a year after the local removal, a small nodule developed to one side of the scar and this has slowly grown. Later two other nodules developed in close proximity to the first recurrence and these have slowly but steadily grown for the past eleven years until they fused together into a three knobbed tumor which during

Fig. 1. Cystadenoma in a male breast.

the past few years has been attached to the skin overlying the tumor. The skin has become thin, shiny and discolored, ranging from blue at the base of the tumor to red at the apices of the three prominences. During the past two years, a small tumor the size of a walnut, has been developing apart from the main mass at the lower border of the pectoralis major in the lower outer quadrant of the breast. This tumor is only slightly attached to the skin and has relatively little

color change over it. All of the tumor mass is movable on the pectoralis fascia. The axillary glands are not enlarged.

The preoperative diagnosis was tumor of the male breast, probably sarcomatous in nature, due to its resemblance in appearance to sarcoma of the fascia lata, for example, which in color, consistency, nodular appearance and attachment to the skin is closely simulated. Against this diagnosis was the general health of the patient, the length of time the tumor had been present, mobility of the tumor on the fascia of the pectoralis and absence of metastases.

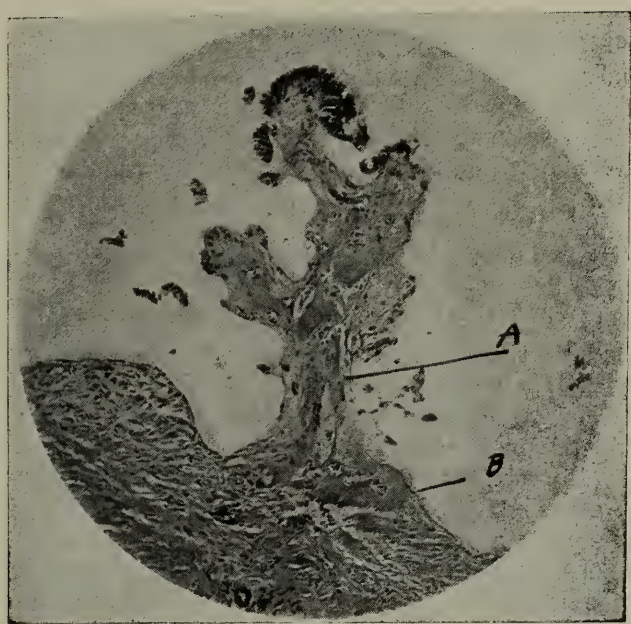

Fig. 2. A. Papillary outgrowth arising from the cyst wall. B. cyst wall. Note absence of epithelial lining.

The tumor, including all of the skin over it, was widely removed as well as all of the pectoralis major muscle and fascia up to the attachment of the muscle to the humerus. This was done under local anesthesia and was well borne by the patient. A defect the size of the palm of the hand was left which was Thiersch grafted three days later. All of the grafts took and the old man was discharged from the hospital. He has been under observation only four months but up to the present time is well and relieved of his discomfort.

PATHOLOGY OF THE TUMOR REMOVED

On cut section, the tumor nodules were found to be cystic, containing bloody fluid under tension. For the most part the walls of the cysts were smooth but over areas of from two to three centimeters on the walls of the several cysts, small sessile hyalin looking bodies were seen, which though not

arborescent in character, grossly resembled papillary projections of the epithelium. Sections through these areas did not reveal any tendency to breaking through the walls of the cysts.

Microscopically, the walls of the large cysts were not covered with epithelium but projecting into the cavity of the cysts were stalks of connective tissue containing blood vessels which were covered with low columnar epithelium. At no place were epithelial cells found invading the wall of the cysts or the stroma surrounding them. Free, unattached pieces of epithelium of the same papillary form were found in the several cysts.

The stroma was rich, had numerous areas in which blood pigment was seen as well as areas of hyalin degeneration of the connective tissue and regions which contained clumps of round cells.

The diagnosis was recurrent papillary cystadenoma of the ducts of the breast.

In reviewing the literature a small number of similar tumors occurring in the male breast were found recorded. Perhaps the most elaborate description of a case is by B. Worbs[14] who made the case report the subject of an Inaugural Dissertation (Bonn 1902), a copy of which I have been able to get from the library of the Surgeon General at Washington. His patient was a male, 45 years of age, who for ten years had noticed a tumor under the nipple which was accompanied by an occasional discharge of milky fluid from the nipple. The tumor had gradually grown in size until it reached the size of a fist and the skin became blue over it. The nipple became slightly retracted but no axillary glands were palpable and the tumor mass was movable on the fascia of the pectoralis major. The author removed the tumor leaving the muscle and fascia under it. On opening the cysts, which had bloody fluid contents, the walls were for the most part smooth but in places contained small cauliflower excrescences which nearly filled some of the smaller cysts. One small cyst was completely filled with papillary outgrowths and gave the appearance of a solid tumor. On microscopic section, the cysts were lined with high cylindrical epithelium and sections through the papillary structures showed connective tissue stalks covered with low epithelium. The stroma around the cysts was rich and contained many areas of round cell infiltration.

Case 2—Reported by Strasser[15] and quoted from Deaver and McFarland, was in a male 63 years of age with a tumor of the breast of four years' standing, which had been

accompanied with a sero-sanguineous discharge from the nipple.

Case 3.—Reported by Russell[16] and quoted from Deaver and McFarland, was in a male breast where no discharge from the nipple had been present but upon removal of the breast a cystadenoma of the duct was found.

Case 4.—Reported by Willams[17] and quoted from Deaver and McFarland, concerns itself with a pathological specimen from the male breast in the Hunterian Museum which corresponds to the tumor under discussion.

Case 5.—Tietze[13] reported a breast tumor in a young man where first one breast and then the other was involved by a tumor about the size of a walnut and was accompanied by pain. On removal of the tumors and microscopic examination of the same, a rich connective tissue stroma was found surrounding a cyst wall which had definite infoldings and which produced papillary structures in the cyst. This is a case where some doubt exists as to the papillary cystadenomatous character of the tumor.

Case 6.—Reported by Greenough and Simmons as a case of Dr. William Conant[18] at the Massachusetts General Hospital, where a male 51 years of age had a tumor of the breast, walnut in size, which had beeen present four months. The tumor was in the upper outer quadrant of the breast and was accompanied by a bloody discharge from the nipple. At operation a papillary cystadenoma of the ducts was found and the breast was amputated. At the end of sixteen months the patient was well and no recurrence had taken place.

Case 7.—Blasius[19] removed a pea-sized papillary cystadenoma from a male breast.

Case 8.—Gowland[20] reported a duct cyst in a male breast.

Case 9.—Hewett[21] observed a papillary cystadenoma of the duct in the breast of a male 55 years of age.

Case 10.—Silva Amado[22] observed a cystadenoma with papillary outgrowths from the cyst wall in a male.

Case 11.—Morgan[23] reported a papillary cystadenoma of the male breast.

Several cases are reported where carcinoma developed upon what was a benign papillary cystadenoma of the duct in the male breast (Peachell [24] Shattuck[25] and others).

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FOR DISCUSSION SEE PAGE 383

TUMORS OF THE BREAST

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I have recently reviewed 107 cases of tumor of the breast that have come under my care. I have analyzed these cases from the clinician's point of view, and have divided them into five classes:

First: Clinically cancer.—Tumor of the breast accompanied by a sufficient number of signs and symptoms to justify the diagnosis,—that is, they presented those signs and symptoms which make the diagnosis unmistakable. There were 64 cases, or 60 per cent in this group.

Second: Potentially cancer. Tumor or induration of the breast which is permanent, but is not accompanied by a sufficient number of signs and symptoms to justify a completed diagnosis of cancer, but has those elements which are commonly found in the pre-cancer stage. There were 26 cases, or 24 per cent in this group.

Third: Doubtful cases. Tumors or indurations of the breast which are soft and of doubtful permanency unaccompanied by other signs or symptoms, but which at the same time make it imperative that the patient be under frequent observation until they either disappear or their permanency is established. There were 13 cases, or 12 per cent in this group.

Fourth: Inoperable cases. Cases in which other organs than the breast or the glands are involved, or in which the resistance of the patient is so reduced as to make even a palliative operation impos-

sible. There were 4 cases, or 3.5 per cent, in this group.

Fifth: Microscopical diagnosis. This should not be undertaken except where facilities are at hand to complete it and act on its results during the operation. There were 51 cases, or 48 per cent in this group. The cases in this group are also comprised in Groups 1 and 2.

Of course microscopical examination of the excised tumor, breast, or glands is always desirable as confirmatory evidence of its character.

The cases studied do not include all that have come under my observation, for the reason that my early cases were not carefully enough recorded, and some of the late cases were only seen once or twice and the record was not sufficiently complete and uniform to be of value. Other patients were operated on away from the hospital. The study points out the desirability of a uniform system of record from the beginning of one's practice.

The procedure in all the cases has been to base treatment on the clinical diagnosis, and the microscopical has been used only to fortify the clinical. Many recent studies of carcinoma of the breast have shown how frequently the clinical diagnosis is at variance with the microscopical. In this series 18 per cent of those reported benign by one of our best laboratories had recurrences within the first two years.

This study of a group of cases of tumor of the breast has been stimulated by three principal considerations:

First, a desire to know what my results have been.

Second, the fact that the teaching regarding the diagnosis of cancer of the breast in our medical schools is not always in harmony with the best of the most recent developements on the subject. As an examiner in surgery of candidates for license in Illinois, I found that fully 90 per cent of all the

candidates, whether recent or old graduates, failed to answer the question "Describe an early case of cancer of the breast and outline the treatment," in a satisfactory manner. In fact they showed plainly that they had not been taught the signs and symptoms of early cancer, not to say anything of potential cancer. Pain, retracted nipple, dimpling, enlarged glands, immobility of mass, and emaciation were to be found in 90 per cent of the answers, yet these are all admittedly late signs and symptoms. The only conclusion is that the teaching in our schools does not place sufficient emphasis on early and potential cancer.

Third, Much of our book literature, even some which is quite recent, is not in harmony with the latest development of the subject,—for example, a recent work on surgical diagnosis contains a scant four pages on "Neoplasams of the Breast," and does not contain a suggestion of the impossibility of arriving at an early differential diagnosis. The author does not call attention to the fact that benign neoplasms quite frequently prove to be malignant, and that all neoplasms of the breast must be regarded with great suspicion. One would be led to think that the differential diagnosis consisted in following out a simple set of rules as to the hardness, mobility, etc., of the growth.

A study of some recent books will reveal the frequent use of such loose expressions as "generally," "as a rule," "usually," "more frequently," "early enlargement in the axilla," "pain as an early and marked symptom," and "early cachexia." Such expressions in dealing with this disease are, to put it mildly, pernicious, and do not help the reader to arrive at a proper conception of the subject. A common fault is that there is so little attempt to differentiate early from late cases, and often no suggestion that a so-called benign growth may speedily become malignant or, in fact, may already be malignant, although all clinical signs favor a diagnosis of benign tumor. A number of authors fail to point out the great diffi-

culty in arriving at a diagnosis and the numerous sources and causes of error. They fail to bear down upon the fact that tumors of the breast may contain elements of malignancy which are impossible to diagnosticate. One cannot analyze a group of cases without being confronted frequently with the fact that a tumor which by all the older rules of diagnosis was believed to be benign has unexpectedly proved to be malignant. Authors have not been sufficiently insistent on the fact that the patient's life is staked on an early diagnosis.

The following observations and deductions seem to be justified by this clinical study, as well as from a study of the latest and best literature of the subject.

In dealing with this subject it should be a maxim that all benign tumors of the breast may become malignant, and that some tumors which seem to be benign may already be malignant. My statistics show plainly that, if this policy could always have been faithfully followed, several secondary operations would have been avoided and several lives saved. A careful study of benign tumors shows that each one in turn has frequent exceptions when it is found to be malignant[8].

When we come to consider treatment of tumors of the breast it is nothing short of a surgical crime to await an accurate pathological diagnosis. Some of the commonest diseases of the breast may lay the foundation for malignancy, and there is no way in which we can tell whether or not in a given case malignancy has already taken place. Chronic interstitial mastitis is often confused with carcinoma. In fact it seems to be well established that malignancy may occasionally give rise to chronic mastitis.[5] Chronic cystic mastitis is an even more dangerous condition, and breasts which are clinically described as cystic should always be regarded as dangerous, as malignancy may already be present.[5] Cysts of the breast are commonly of duct origin, and the ducts may already contain the beginnings of malignancy.

The smallest and most freely movable adenomas may prove the starting point for a rapidly growing cancer.[2]

Metastasis has been known to take place notwithstanding the fact that the microscope reported a non-malignant fibro-adenoma. In my own cases 18 per cent that were pronounced benign by one of our best laboratories had recurrences. This is not a criticism of the laboratory, but emphasizes the difficulties of diagnosis. The time has come when we must admit that a positive clinical diagnosis of cancer of the breast cannot be made sufficiently early to justify using it as a basis for surgical treatment. How are we to say that a given growth which is clinically benign does not already contain elements of malignancy? A growth which is benign this month may be malignant next, or more likely already contains elements of malignancy.[13] Much effort has been spent, by some authors, to make a differential diagnosis between benign and malignant growths, and the following quotation from a well-known author well describes the futility of the effort.

"If the tumor (breast) has only been present a matter of months it is probably cancer, if a year or more it is fibro-adenoma. Further, fibro-adenoma not rarely undergoes cancerous changes, and this alteration is not signified by any recognizable clinical symptoms."[13]

After an elaborate and detailed description of how to differentiate innocent from malignant tumors of the breast, another author concluded by saying, "But unfortunately there are exceptions which cannot be differentiated."[13]

We cannot rely upon time as a principal element in arriving at a differential diagnosis. Carcinoma may originate in a breast and be present for years without giving rise to a palpable tumor.[11]

Is it not a situation where we are driven to the conclusion that all benign tumors of the breast should

be removed, for the very good reason that a positive differential diagnosis is impossible.[10] Instead of elaborate efforts at differential diagnosis, would it not be better to adopt the maxim that "Any lump in a woman's breast is better out than in?"[10]

The onset of cancer of the breast is so insidious that we have little to guide us in its early stages except the presence of a growth. Usually the patient feels no pain, but simply discovers a lump in the breast accidently. There is no accurate way to know how long it has been in the breast.[12] We may be able to make a positive diagnosis of a benign nodule in a breast and the microscope may reveal a cancerous development at a distance in a duct.[9] A recent author suggests that no benign tumor of the breast ever becomes more benign,[6] and concludes with the advice that all benign tumors should be removed. It is a question whether it would not be safer, for the great majority of patients, if every breast containing even a benign tumor was removed. Would it not be better to accept the dictum of a prominment author who says, "The early removal of a hundred unproved tumors is better than to deny one woman deliverance from cancer of the breast."[7] Should we adopt such a dictum we should certainly save many women. By the law of averages we know that the great majority of tumors of the breast are either malignant at the time of observation or will soon become so. Is it not a fact that the great variation of malignant forms renders it imperative that all mammary growths should be removed?[13] If we are to do the greatest good to the greatest number, operations must be done in a number of questionable cases in order to give the patient the benefit of the doubt.[1] There is certainly a growing feeling among surgeons that all tumors of the breast, whatever the belief as to their character, should be removed rather than await the signs and symptoms by which a positive diagnosis of cancer can be made.[12]

There is another reason for removing the whole breast in cases of tumor, especially those where there can be the least doubt as to the existence of malignancy. A comparatively recent report (Johns Hopkins Hospital) shows that where the indurated mass of chronic cystic mastitis is removed and a microscopic examination reveals carcinoma, even though a radical operation is done within a few days, the patient may not be expected to live more than three years.[5] The following rules have been adopted by some hospitals and are worthy of serious consideration.

1. In patients under 30 with chronic cystic mastitis, a partial excision of the breast may be done in selected cases.

2. In patients between 30 and 40 with chronic mastitis, the breast, fascia, and pectoral muscles should be removed.

3. In patients over 36 with chronic cystic mastitis, a radical operation should be done.[5]

4. In every case of doubt in chronic cystic mastitis the patient should be given the benefit of the doubt and a radical operation should be made.

The same rules should be applied to a number of other breast conditions.

The danger of cancer transformation in these cases is especially menacing, as it is also in painful subcutaneous fibromata.[2] [5] The only cases of tumor of the breast where the growth alone can be removed with reasonable safety are small recently developed nodules in women under 30 years of age. Where a tumor is of moderate size or has shown any recent tendency to increase in size the whole breast should be removed.[10]

Where any considerable portion of the glands are involved the whole breast, fascia, and muscles should be removed as early as possible.[10] Occasionally cases

are seen which seem to exhibit primary carcinoma of the axillary glands. In such cases a careful search of the breast tissue will probably reveal the original cancer focus.[11] While an excision should be done in every tumor of the breast in most cases this will prove insufficient, and secondary operations for removal of the breast are unsatisfactory. We must always keep prominently in mind that to withhold early operation in any case which may prove to be cancer may condemn a patient to a wretched and unjustifiable death. A few months' neglect under the guise of an attempt to cure by palliative treatment, so called, and hope may be gone forever.[7] If every tumor of the breast were operated on immediately upon the discovery of the lump the great majority of cases of cancer of the breast would be prevented or cured. By promptly removing indurated areas and benign growths, and by preventing and curing mastitis we shall do much toward preventing carcinoma.[7] There should be no long period of observation in any doubtful growth in the breast; neither should there be any half-hearted surgery for cancer of the breast. Unfortunately, the teachers of surgery, as well as the surgeons in active practice, need to be more thoroughly impressed with the fact that the only hope of cure rests on early and complete extirpation, and not on prolonged effort at a differential diagnosis. To our disgrace the majority of patients with cancer come to operation too late to be cured. Using the words of a prominent author, "Most cases of cancer which come to the surgeon are, alas, too easily diagnosed."[7]

I have often wondered just what we understand, each one for himself, by the cancer question. The backbone of any movement for the prevention, as well as the cure, of cancer must be the medical profession, and until we are more alive to a more hopeful and rational view of the handling of cancer, little progress can be made. Following Virchow's announcement of his cellular pathology, the whole energy

of the profession was devoted to the determination by the use of a microscope, whether or not a given tumor mass contained cancer cells. We were taught to consider it a disgrace for a surgeon to remove a growth as cancerous and have the pathological report show that it contains no cancer cells.

This theory contains two important fallacies: first, that it is possible to make a clinical diagnosis of cancer in a given case; and, second, that it is not possible for the pathologist to detect all cancer cells in a given tumor by ordinary methods.

I judge that the great majority of physicians still hold these fallacious views, the repeated failure of which has brought about much of the present hopelessness regarding the treatment of cancer. Such a view also has an important relation to our methods of diagnosis.

Suppose that the question was asked of a hundred physicians at random, What are the signs and symptoms of early cancer of the breast? What do you suppose would be the answer? What element would they depend upon for an early diagnosis? Remember that the emphasis is placed on the word *early*.

From my experience with State Board Examinations, mentioned above, I am led to fear that fully 90 per cent of our physicians would answer the question in a very unsatisfactory way. In other words their early diagnosis would contain such elements as pain, enlarged glands, retraction of the nipple, and dimpling in breast cases, and even emaciation and cachexia. As a matter of fact, all these signs and symptoms are late, very late. When a patient consults a doctor, and presents a tumor mass, with enlarged glands, pain, emaciation, etc., we have already an advanced case of cancer. Just here is where we are failing as a profession to give the people the benefit of the latest and best teaching regarding cancer. In fact, if we are to give the greatest aid to cancer cases we must bend our best energies

to prevention, and not to an effort to eradicate the already fully developed disease.

As a profession we are wasting time for the patient in trying to make a positive diagnosis before we initiate appropriate radical treatment. We are neither teaching nor practicing the treatment of potential cancer. I take it that the trouble with the cancer question is with the medical profession itself rather than the people. There is every indication that the people are anxious to learn about cancer. About every case I see has previously been examined by one or more physicians who have used more effort to allay the fear that the lump she or he has may be cancer, rather than to institute vigorous radical treatment at a time when such treatment will be most effective.

DATA FROM PERSONAL CASES

The cases comprised in this study were referred by forty different physicians; only a small proportion of them coming to me primarily.

The following tables give the fundamental facts regarding these patients.

1. Total cases studied, 107.

2. Sex: male 2; female, 105.

3. Civil condition: children, 2; married, 66; widows, 14; single, 25; or married, 75 per cent; single 25 per cent.

4. Ages: under 1 year, 1; 15 to 20 years, 2; 20 to 30 years, 8, 10 per cent; 30 to 40 years. 30; 40 to 50 years, 34, 62 per cent; 50 to 60 years, 12; 60 to 70 years, 11; 70 and over, 7, 27 per cent; unrecorded, 2. Total, 107.

5. Occupations: Infant, 1; student, 2; housekeeper 1; bookkeeper, 2; nurse, 4; seamstress, 8; teachers, 8; housewives, 76; farmer, 1; cigarmaker, 1; not stated, 3; total 107.

6. Time elapsing from first appearance of a lump in the breast to first observation by surgeon:

Under six months	23
6 to 12 months	5
12 to 24 months	18
24 to 36 months	11
36 to 48 months	2
48 to 60 months	2
60 to 72 months	2
72 to 84 months	1
Not stated	43
Total	107

The tumor had been observed by the patient for more than a year in 56 per cent of cases. Not infrequently they had been under some form of treatment much of the time.

The main interest in this analysis centers around that group of cases which were clinically cancer (No. 1) at the time they consulted the surgeon.

The following facts apply to these cases:

Total number of cases	64
Number operated on	60
Total number of operations	87
Recurrences following operations	42
Cases having no recurrences	18
Well at the end of one year	2
Well at the end of two years	8
Well at the end of three years	4
Well at the end of four years	2
Well at the end of five years	18
Total number of patients well November 1, 1921	34

	Per cent
Well at the end of five years	30
Well from three to five years	40
Well from one to five years	50

No report received from twelve patients.

Inoperable	4
Microscopical reports of cancer	33
Microscopical reports of no cancer	16
No microscopical examination	27

There was no operative mortality.

Five cases which had recurrences and were re-operated on lived five years or longer.

Only 12 per cent of the cases which had fully developed clinical signs were well five years.

Potentially cancer ..... 26 cases

All advised to have nodule removed for microscopical examination.

One case which was congenital has since been operated on and microscopical examination showed growth to be benign.

Five cases were lost sight of, having only been seen a few times.

Five still have nodules, but no other development, although there is still ample opportunity.

Fifteen had either the tumor or the whole breast removed.

Eight cases originally classified as "potentially cancer" were transferred to the "clinically cancer" group, upon finding enlarged glands in the axilla which could not be palpated.

Doubtful diagnosis, 13 cases.

These cases could not be followed; several were only observed once or twice. All were advised to report at least every three months for examination. No operation advised.

The following clinical facts were recorded:

Primary soft or undefined nodule in the breast 7 cases.

Recurrent nodule in breast, axillary glands, or scar from previous incomplete operation, 7 cases.

Primary hard nodule in the breast, 89 cases.

Whole breast a mass, 13 cases.

Retracted nipple, 14 cases. Not including the cases where the whole breast was a mass, because in practically all these cases the nipple was retracted.

Dimpling, 6 cases.

History of injury 3 cases.

A number attributed pressure of clothing as a cause, but this was more or less uncertain.

History of infection, 7 cases.

Axillary glands on the same side involved, 54 cases.

Cervical glands enlarged, 11 cases.

Mediastinal glands involved, 2 cases.

Pain was a factor in 44 cases.

Recurrence in the scar in 18 cases.

Recurrence in the cervical or mediastinal glands in 7 cases.

In several cases there was recurrence in several of the sites named.

Post-operative swelling of the arm in 6 cases.

Recurrences were as follows:

After primary nodule was excised, including the cases where the nodule was excised for diagnostic purposes and complete operation made later, 16 cases. After the breast was excised, 3 cases. After the primary breast, muscles, and glands were excised, that is, a complete operation, 7 cases.

Several cases had more than one recurrence, as follows:

Two recurrences in 9 cases.

Four recurrences in 1 case.

Primary nodule was excised and followed by complete operation and no recurrences reported in 8 cases.

Primary excision of the breast alone in 6 cases, with recurrence in 3 cases.

Total operations, 102.

Three patients had 4 operations.

Four patients had 3 operations.

Fifteen patients had 2 operations.

Fifteen patients refused to be operated on.

Operation was refused to 5 cases.

Advised observation in 10 cases and no operation was required.

In seven cases which were classed as potentially cancer the laboratory report was positive as to cancer.

This transferred another group which I had originally classified as "potentially cancer." Originally the "potentially cancer" group contained 41 cases, but the developments at operation reduced the number to 26 cases.

I cannot say that I am extremely proud of my results in cancer of the breast, but I place them before you, such as they are, with the hope that by a frank presentation and discussion we may develop new energy and take new hope in dealing with these cases.

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DISCUSSION OF THE TWO PRECEDING PAPERS

Dr. Byron B. Davis (Omaha, Neb.): I agree so fully with what has been said that I know of nothing special that can be added. However, this is a subject in which I have been interested for a good many years. As long as the average text-book, in giving the symptoms of cancer, gives the symptoms practically of the terminal stages of cancer of the breast, instead of the early symptoms, and as long as we permit our medical students to go out without having more knowledge of the early symptoms of cancer, I do not think we are going to make very much progress. Unfortunately, the test which Dr. Black made in asking the questions with reference to the early symptoms of cancer would be wrongly answered by most recent graduates.

In regard to the removal of tumors of the breast: I have held for many years that every tumor of the breast should be removed; and for fifteen years, unless I was caught napping, I have not attempted to remove a benign tumor of the breast

without having a pathologist present with a microtome prepared to make a frozen section as soon as the tumor was removed. I do not consider the operation complete until I get a report from him. If he finds malignancy a radical operation is done at once. If he does not find malignancy I close the wound, the pathologist takes the specimen to his laboratory and makes a lot of sections, and, if he discovers after giving the sections more careful and thorough examination, any malignancy I go ahead and do a radical operation. In four or five instances he has failed to find malignancy at the time of making the frozen sections, but has found it later, and in every one of these cases a radical operation was done as soon as cancer was discovered.

I fully agree with Dr. Black as to the precancerous condition. If we can only get to the point where we can describe and recognize these precancerous conditions and have the courage to act upon them, it seems to me we may make some progress. Even pathologists are taking cognizance of this. Ewing has had a lot of breasts for examination that were amputated for chronic cystic mastitis, and you will find in the last edition of his text-book that in 50 per cent of the cases which he examined he found the very early development of carcinoma in some portion of the breast, or he found what he considered was an absolutely precancerous condition, and that cancer could be expected to develop before long. I have come to the conclusion in cases of persistent chronic mastitis that we will do better service to our patients if we do a simple amputation, which is very different from a radical operation. By so doing I believe a lot of lives would be saved. In following this policy we may remove some breasts that would never become cancerous, but in that way we would save thousands of lives.

Dr. James F. Percy (San Diego, Calif.): This subject is so important and Dr. Black has developed it in such a striking way that I want to add a plea for what I believe to be the correct method of deciding about the case that we are often in doubt about. A woman does not want to lose a breast, and yet she wants to be sure that she does not have cancer. I would recommend that an incision be made with the cautery knife along the lower breast line, lift it up, and dissect out the tumor with the cautery, replace the breast, suture it, and stick in a small piece of rubber dam as a drain. The whole mass removed can then be examined in the laboratory without haste and with a much better chance of finding the malignant part of an otherwise benign mass. Wherever the cautery touches the tissues of that growth cancer is killed, if it is there; and, in addition, you build up and leave a wall through which cancer cannot go. In other words you do not disseminate the disease while you are awaiting the report from

the pathologist. If the mass proves to be carcinoma you can then do a radical operation without having subjected the patient to any unnecessary danger from your preliminary procedure. In this way many of these breasts can be saved, and what is more important, you can always be quite certain of knowing where you are with a given case.

Dr. Willard D. Haines (Cincinnati, Ohio): I take it the great lesson we are to draw from Dr. Black's efforts this afternoon is a message to assist the people. Surgeons are agreed upon the proposition as presented by the doctor: first, to educate the public and, second, the general practitioner wherever you have a voice. In Cincinnati we have been telling the people in churches, schools, clubs, legislatures—wherever we meet our fellow-men and women—about cancer. The things mentioned have been copied from one text-book to another throughout the past generation, and they stay there as authoritative statements to-day. If, when you have an opportunity, you will read the literature on cancer put out by the various societies and will present the subject as Dr. Black has presented it to-day, we shall get the patients at a time when treatment of cancer will greatly advance the patients' chances for permanent relief.

In the main, we can tell people that cancer has no symptoms. We have been taught that the symptoms of cancer of the breast are retraction of the nipple, infection, and loss of weight. These are not symptoms of cancer, but are signs of death.

Dr. William T. Reynolds (Kansas City, Mo.): Dr. Haines has just expressed what I was going to say, but it needs to be emphasized repeatedly. We have passed through the publicity cycle in tuberculosis. At the present time the ravages of this disease have become so important that there is a national and everlasting day-by-day propaganda of how to take care of a patient with this disease and how to early recognize it. We are confronted with, and should carry out, the same publicity in regard to cancer. Inasmuch as 80 per cent of all tumors of the breast that are discernible are potentially, if not in fact, malignant, we must educate the people to the seriousness of this condition and warn them that their safety lies in early recognization and that they should always be regarded as dangerous and that medical and surgical advice should be sought at the earliest possible moment.

Dr. Miles F. Porter (Fort Wayne, Ind.): Before I rose I thought every man in this house probably was aware of what I want to tell you until I heard this last speech I know a lot of you know about the thing of which I am going to speak. I know my friend from the banks of the muddy Ohio

should know about it. There is an organization known as the National Society for the Control of Cancer, and every member of the Western Surgical Association should be a member of it if he is not already. This society is doing exactly what Dr. Reynolds said should be done. Not until we educate the public to know what they should know about cancer and its ravages shall we be able to do what is possible for us to do in the way of curing cancer with our present knowledge.

Dr. Aubrey H. Williams (Denver, Colo.): It has been my privilege and pleasure to have worked with the President of the National Society mentioned by Dr. Porter. It gave me quite an insight into the activities and endeavors of this organization, and I wish I had the actual facts which I have seen and read from the reports of the various chairmen of the various states, cities, and towns throughout the entire United States, relative to this question. One thing that we have determined upon at home is not to permit this movement to die. We have succeeded in arousing to a large degree popular interest. We gave in Denver in a rather experimental manner a public clinic to which all people are invited to come for which no charges are made; and also in our recommendation to the applicants, in order to make it altruistic in the extreme, we have requested them not to go to the men they had seen at the time of the conference, but to some good surgons and have their cases attended to. At the first conference or clinic we had three hundred and fifty; the second day we had seventy-five, there being only two days we had made arrangements for this work. The results were so satisfactory to people coming there that we discovered almost thirty cases of what you might consider as being in the curable stage or precancerous stage, and we gave them our advice relative to treatment. I am gratified to say that in Denver we are going to continue, at least once every three months, holding a free consultation probably at the County Hospital.

Dr. Black (closing): I am under obligations to Dr. Porter for bringing up the matter of the work that is being done by the American Society for the Control of Cancer. I was asked by the chairman of the committee in my county to put on a campaign, and I did not know exactly how to go about it. However, I put it on in my own way. I did this: I asked the doctors if they would give three hours on two consecutive afternoons to talks on the cancer question. I had thirty-four volunteers out of a profession of seventy. We divided up the county so that there were school-houses in each district arranged according to convenient roads, so that a doctor could speak in three schools. At first there seemed to be some objection to talking to children, as they do not have cancer, but, after more mature consideration, we concluded the chil-

dren would grow up after awhile, and, in addition, all of them would have parents. We hit on the scheme of having the speakers distribute a small pamphlet and get their promise to read this pamphlet to their parents. They held up their hands promptly and agreed to take the pamphlet and read it, and in this way we distributed in two afternoons over twelve thousand pieces of literature to teachers and students, and we have reason to believe that this little pamphlet will be read in at least three thousand homes in our county. All of this was done in five hours actual work by thirty-five doctors in two afternoons.

SURGICAL TREATMENT OF ABSCESS OF THE LUNG

Oscar M. Shere, M. D., F. A. C. S.

DENVER, COLORADO

Abscess of the lung is a disease which all of us encounter from time to time as part of the routine of our general surgical work. Within the past few years, however, with the increased number of nose and throat operations, teeth extractions, and especially as a result of post-influenzal pulmonary complications, this condition is more often met with than heretofore.

Despite the material increase in the number of such cases, patients are not infrequently observed in whom at least a tentative diagnosis had been sufficiently obvious for a long period, and yet they were permitted to go on without any adequate effort upon the part of the physician or surgeon toward alleviation or cure of their desperate affliction, which makes them a burden, not only to themselves, but to those around them, as well.

This seeming dereliction on the part of clinicians may be exonerated by the fact that the medical treatment of this disease carries with it an extremely high mortality (54 per cent in 132 cases collected by Walker,[1] over 90 per cent—Tewksberry[3]), while the surgical methods for the relief of pulmonary abscess still bear a very unenviable reputation.

Whenever such a status of therapy prevails in any pathologic condition the treatment of choice must needs become expectant, which in this instance simply means that the patient is expected to make his exit

or get well in spite of our expectations. The question is, Do they get well? Even if spontaneous recovery by rupture into a bronchus does take place occasionally, I doubt very much if such an outcome may be conscientiously placed in the column of cures.

It is because of this masterly inactivity that I am prompted to present this subject before this Association. In doing so I am hopeful that a free exchange of views may help to crystalize operative indications, standardize the surgical technic, and solve this vexed problem in general.

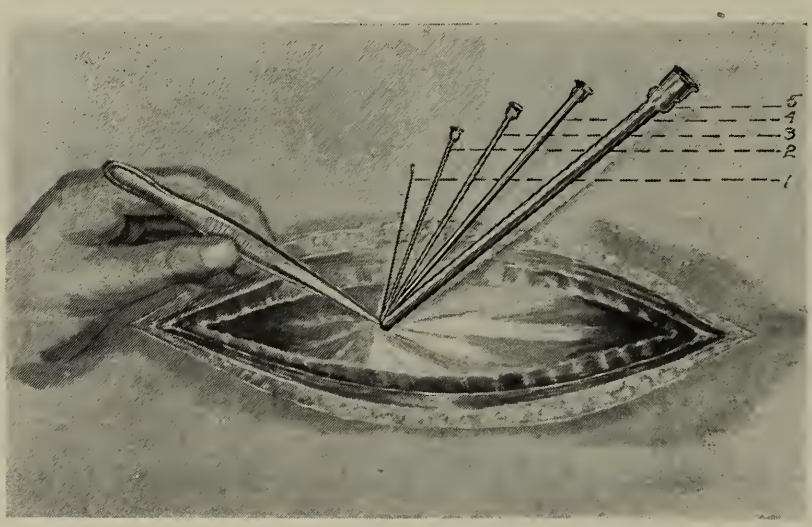

Fig. 1.

In approaching a rational treatment for this disease, we need to fix our mind especially upon two chief factors, one being the pathologic process resulting from the numerous and varied causative agents and the other the natural process of repair, the imitation of which should constitute our distinct aim.

From the pathologic viewpoint the etiology plays but an unimportant part. Considering the great variety of causes which may be present in the pathogenesis of this condition, whether it be a sequence of pneumonia, tonsillectomy, septic infarct, or trauma to the chest wall or lung, we at once realize that primary suppuration of the lung rarely, if ever, occurs. From

the standpoint of therapy, on the other hand, the etiology is of considerable import, since Tuffier's statistics show that the results depend in large measure thereon. Thus, for example, cases following pneumonia offer a much higher percentage of recovery from operative interference than abscess following emboli, trauma, or a general infectious process.

The discussion of the pathology in this paper must of necessity be brief. In a general way the abscess usually follows a series of progressive inflammatory changes of the secondary lobules with ultimate destruction of pulmonary tissue. If this destructive process leads to the formation of larger sequestra a gangrenous condition supervenes. The abscess area, when viewed on the external surface of the lung presents a whitish gray color, while that of the gangrenous zone is brownish or greenish-black, resembling in appearance a gangrenous gall-bladder, which is a rather familiar picture to all of us. Either process rapidly leads to cavitation. In the more chronic cases the cavity becomes lined with a false membrane[9] of granulation tissue or may even be surrounded by a newly formed connective tissue. In this class of cases this pyogenic membrane continues to secrete pus until it is completely sloughed off and, if replaced by fibrous tissue, may, in isolated instances, heal spontaneously by cicatrization, while in gangrene this very membrane is apt itself to fall victim to necrosis and thus permit gradual extension of the gangrenous process. From a clinical standpoint, however, the differentiation of abscess from gangrene is of negligible value. In contradistinction to this it is of paramount importance to differentiate true abscess of the lung from that form of pulmonary suppuration which is only incidental in the process of generalized bronchiectesis.

While the same etiologic factors involved in the pathogenesis of abscess may prevail in bronchiectasis, —in fact the clinical picture of the latter may indeed be very much allied to that of the former in such

symptoms as fetid purulent expectoration, cough, dyspnea, etc.—we must, nevertheless, take cognizance of the distinctly different pathology of the two conditions. Whereas in abscess the area involved is usually limited to but one part of a single lobe, in bronchiectasis of the generalized purulent type we have multiple sacculations, varying in size, as well as in

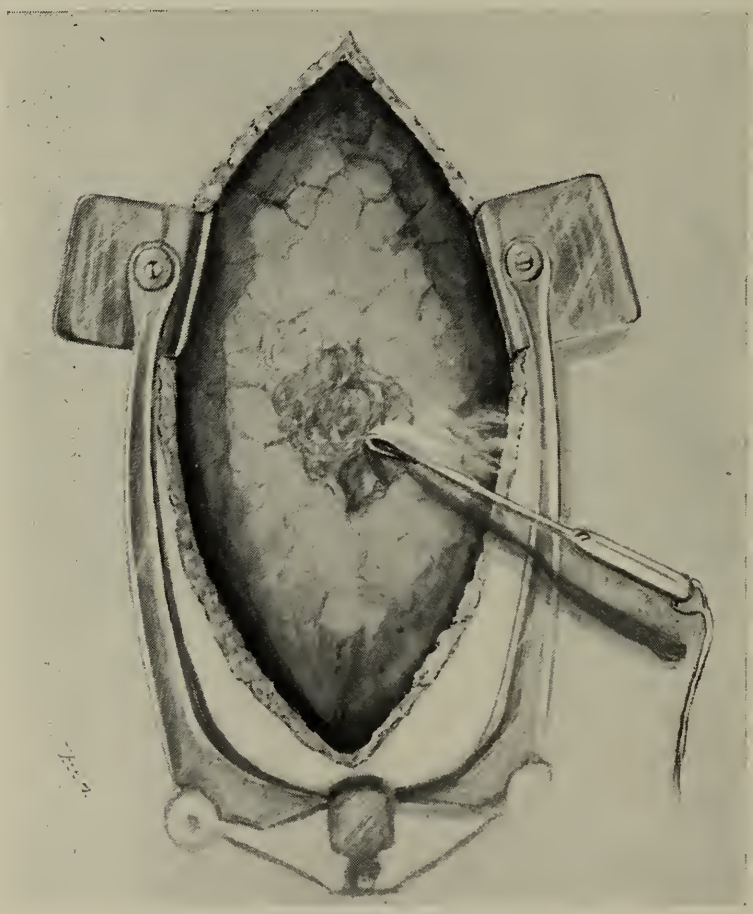

Fig. 2.

number, and involving most of the bronchi of an entire lung, or, if the process has been unusually protracted, the same changes may manifest themselves on both sides. It is, therefore, self-evident how futile a mere drainage operation would be in cases of the latter type.

From the foregoing it may be readily appreciated how important it is to make a correct diagnosis before

adequate methods of treatment are instituted. Although the literature upon the subject tends to give one the impression that diagnosis in these cases is fraught with a great deal of difficulty one may modestly challenge such contention. The fact is that the sign-posts which point to the presence of pulmonary suppuration are generally sufficiently plain to anyone who will but make the effort to read them. Any difficulty which may exist can be readily overcome if the clinician will take a careful, chronologic, and consistent history in every case. I regard the history of infinitely greater import than physical examination of the chest.

The subjective symptoms elicited in the anamnesis will, at any rate, be sufficient to arouse suspicion, and all one has to do is to call in the aid of an expert radiologist who should make separate sets of stereo-x-ray plates in the prone, dorsal, and lateral decubitus. This procedure will not only suffice in settling the diagnosis, but, what is equally important from the surgeon's point of view, it will demonstrate the localization with a fair degree of accuracy. Examination of the sputum for elastic and leucocyte count, as well as the physical findings, should be done as a matter of routine with the understanding, however, that they do not merit the same reliability as that accorded to the history and the radiograms.

By following the above outlined plan in every case many patients will reach the surgeon long before they present symptoms of a general septic condition.

While on the subject of diagnosis a few words relative to the use of the aspirating needle may not be amiss. Lehman[7] claims to have never seen any hemorrhage, nor the spread of infection from the use of the needle. He uses it freely and fearlessly always avoiding a general anesthetic, insisting, however, on a long and not too large a needle and a perfectly air-tight syringe. Hedblom,[8] on the other hand, says "the use of the aspirating needle in a diagnosis of abscess is decried by most surgeons, if

not by all. Even if adhesions prevent infection of the pleura, deep cellulitis of the chest wall may supervene." Many other citations may be quoted for and against the use of the exploratory puncture. Personally, I am greatly opposed to its use, not simply because of the danger of infection, but also on account of the so-called pleural shock accompanying this procedure, which sometimes results fatally. I know of two deaths within a year from simple exploratory puncture. Leaving everything else aside I

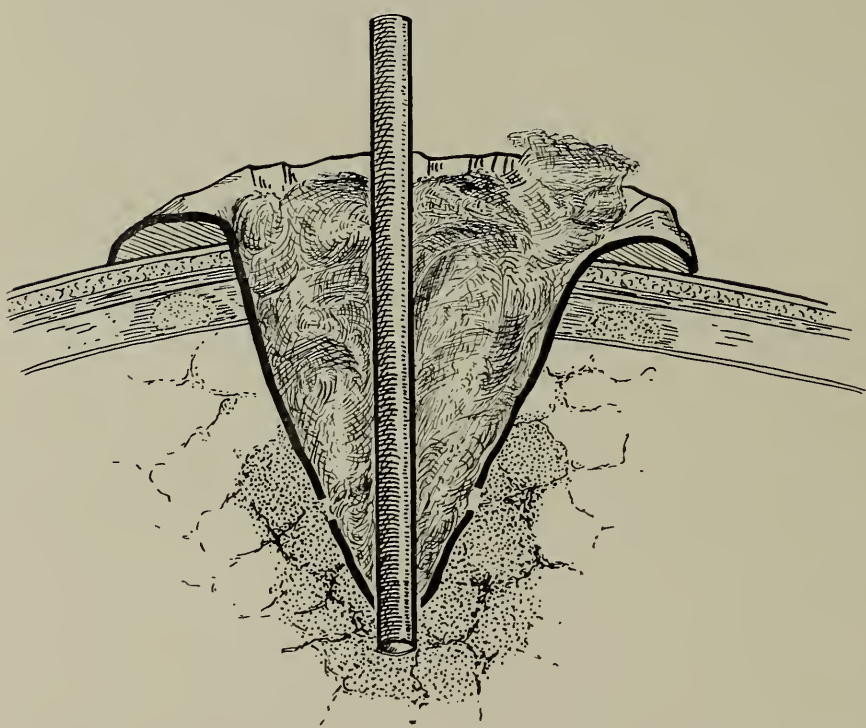

Fig. 3.

have abandoned its use because I am convinced that the method is not of great diagnostic value.

The diagnosis having been made there is, in my opinion, but one method of treatment, and that is surgical intervention in every case of lung abscess, be it acute, chronic, or tuberculous, with but very few exceptions.

At first glance this may sound iconoclastic in view of the varied treatments reported by different authors,

such as the use of artificial pneumothorax, bronchoscopic irrigations, vaccines, etc. Upon careful analysis, however, we must admit that an abscess, irrespective of its location, calls for drainage and that abscess localized in the lung forms no exception to the rule. This position is further accentuated by the fact that when these cases are treated expectantly in the hope that the abscess will drain via the bronchial route, the so-called "spontaneous healing," we have a mortality ranging between 80 and 90 per cent. Considering all references in the literature the mortality from operations in these cases is about 25 per cent. In my own series of nineteen cases, inclusive of four tuberculous cases, I have had but three deaths, or a mortality of 15.8 per cent. Moreover I am sanguine that even this percentage will be lowered considerably if operative relief is not withheld from the patient until general sepsis supervenes.

In outlining the surgical procedure of these cases there are many factors of great importance to be considered. These include (1) pre-operative care; (2) anesthesia; (3) technic of safe thoracotomy and pneumotomy; and (4) post-operative treatment.

PREPARATION OF PATIENT

A few days of complete rest in bed should precede the operation in all these cases. During this period special observation of the heart function, blood pressure, and general circulation should be made, and such treatment instituted as may be found indicated. Digitalis is an extremely valuable drug in this class of patients. Catarrhal conditions of the upper air passages must not be overlooked. Inhalations as well as mild expectorants, are of value in clearing up lung secretion. It is needless to add that general elimination should be carefully looked after. The daily administration of glucose and soda by proctoclysis will be found of value.

ANESTHESIA

While brilliant results have been attained by the use of positive pressure apparatus and intratracheal insufflation in endothoracic operations I am firmly convinced that their employment is not in the least essential. The ordinary drop-method administration of ether, or gas and oxygen are fully as efficacious and just as safe to the patient. The outstanding feature, however, in many cases is that these patients are extremely toxic when they come to the surgeon, so much so that the general metabolism and blood-oxygenation are greatly below par, thereby interfering with the essential requisites of general anesthesia in any form whatsoever. I would therefore, urge the employment of either local or spinal anesthesia as the method of choice.

SURGICAL TECHNIC

Since the days of Boglivus, who performed a pneumotomy, in 1710, there has been a great controversy relative to the operative technic in endothoracic surgery. During these past two centuries every worker in this field endeavored to eliminate the danger of operative pneumothorax, which is the chief cause of fatal asphyxia in these cases. In the course of animal experiments carried on by the writer during the year 1918 and 1919 a technic was developed by means of which this danger may be reduced to a minimum, if not eliminated entirely. Limitation of time will not permit an academic discussion of this most interesting phase in thoracic surgery. Suffice it to say that when air is permitted to enter through the pleural opening slowly and gradually an equilibrium is established between the pressure of the inspired air via the trachea and that entering through the thoracotomy opening to the end that respiration is not greatly impeded and dyspnea is comparatively absent.

This method when applied clinically is carried out

in the following manner. Whether the approach is anterior or posterior, depending upon the localization of the abscess, two or three ribs are resected subperiosteally. The visceral pleura is then exposed, and an ordinary cambric needle is introduced and permitted to remain for about two minutes, when it is withdrawn slowly and a small cannula is then introduced through the opening made by the needle and permitted to remain about the same length of time. This is followed by a larger-sized cannula, and so on until a fair-sized opening through a cannula corresponding in size to a No. 16 English catheter has been made in the pleura. (Fig. 1.) The opening is then sufficiently enlarged for the introduction of a rib-spreader, and the lung which is devoid of collapse is exposed. The abscess cavity is then located, either by palpation or needle, and opened by means of a cautery brought to a dull red heat. (Fig. 2.) Into the cavity a tube is introduced through a large piece of rubber dam in the form of a cornucopia, which is large enough to be spread over the chest, and into this tampon strips of iodoform gauze are packed snugly all around the tube. (Fig. 3.) The rib-spreader is now withdrawn, no sutures are employed, a large loose dressing is applied over the tube, and the whole side of the chest is tightly strapped with adhesive plaster.

The advantages of this modified Mikulicz tampon are many. Primarily, it shuts off the infected area from the rest of the pleural cavity; secondly, it acts as a barrier against the entrance of air from without; and, last but not least, it is extremely comfortable and almost painless to the patient. The gauze is gradually removed, and, in a week or ten days, may be replaced by lighter packing. Irrigation of the abscess cavity may be carried out beneficially in these cases, particularly when a gangrenous process is concomittant with the abscess. Drainage should be kept up until the symptoms, such as fever, cough (except the residual bronchial cough), and foul expectoration, have disappeared, when the cavity will be obliterated

and closure will rapidly take place in the great majority of cases.

AFTER-TREATMENT

For the first twenty-four or forty-eight hours liberal doses of morphine and atropine should be administerd. Posture is of importance. The patient is placed in a semirecumbent position resting on the affected side. The dressings should not be disturbed for about twenty-four to thirty-six hours, after which period they may be changed as often as necessary. The use of creosote carbonate in all these cases, whether the expectoration is fetid or not, will be found of benefit.

Before concluding I wish again to emphasize that every abscess of the lung is a surgical condition, and that with the use of the above-described technic the mortality from operations may be greatly reduced.

I shall now show some lantern slides which were selected from my series of cases in an endeavor to elucidate some of the points made in this very incomplete presentation of the subject.

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A-3

DISCUSSION

Dr. Evarts Graham (St. Louis, Mo.): I think in the main we can all agree with the points brought out by Dr. Shere, particularly about the desirability of considering all these cases as primarily surgical. Lung abscess is primarily a surgical condition. I cannot agree with him, however, on one point, and that is in doing this operating in a routine way in one stage. I believe we can approach these cases with greater safety as a routine if we practice the two-stage operation. There are dangers of going in and finding the lung non-ad-

herent to the pleura. Although one might feel that he is walling off the abscess with his tampon, it seems to me, there might be considerable danger of leakage, all of which can be obviated by doing these operations in two stages. By the two-stage operation I mean, first of all, obliterating the pleural cavity at the point of drainage. That can be done either by suturing the lung to the parietal pleura at the time of the first intervention, or it can be done by a method, which I think was first suggested by Bevan, of packing in iodoform gauze or something of that sort, which will set up pleural adhesions before the pleura is opened.

I agree absolutely with what Dr. Shere said about the use of the aspirating syringe in these cases. Certainly, great harm follows the indiscriminate use of the needle in suspected cases of lung abscess. Most cases of intrapulmonary suppuration can be satisfactorily recognized by the X-ray. It is not necessary in the majority of cases of intrapulmonary suppuration to insert the needle for the purpose of establishing an absolute diagnosis. If intrapulmonary suppuration is suspected, the case should be treated as one of probable abscess preferably by the two-stage method. A rib can easily be resected, the lung made adherent, and one can close the site of entrance by the two-stage method. Three or four days later the lung may be opened by the cautery or by some other method. Usually, in my own experience, there does not seem to be any need of great haste about going in in these cases, therefore the necessity for the one-stage procedure does not exist. In fact, the majority of cases which we see nowadays are cases which have been sadly neglected, in which a delay of three or four days, with the promise of greater safety by the avoidance of empyema, would not make any appreciable difference so far as the bad results are concerned, and, in my opinion, might diminish the mortality.

I wish to compliment the essayist on his splendid series of cases and the excellent results he has achieved by this method.

Dr. Roger T. Vaughan (Chicago, Ill.): A method which seems to be more surgical and cleaner than Bevan's method of obliterating the pleura was brought out in Tuffier's "Chirurgie du Poumon." Tuffier simply uses the actual cautery through an open incision and cauterizes the parietal pleura at a dull red heat, thus causing pleural adhesions to form. Then a second-stage operation is done by reopening the previous skin incision, which usually has healed primarily in the interim. The second stage is then a clean operation, instead of an operation through a not entirely aseptic granulating area as by the iodoform gauze pack method.

Dr. Shere (closing): With reference to the two-stage operation: The cases that came under my observation existed sufficiently long so that we found adhesions in most cases.

I believe that as time goes on and these cases come to us early, a two-stage operation may be of advantage.

Dr. Lockwood: Have you found it feasible to gain sufficient spreading of the ribs, or do you resort to multiple resection?

Dr. Shere: When you introduce the rib-spreader you can expose the entire lung, just as in pelvic work or in any laparotomy wound.

Dr. Lockwood: Do you do it by intercostal resection?

Dr. Shere: Two ribs are usually resected, and with the introduction of the rib-spreader the entire lung is right before you.

TUBERCULOUS EMPYEMA

Lewis H. McKinnie, M. D., F. A. C. S.

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It is generally conceded that the tubercle bacillus can produce a purulent effusion in the pleural cavity—a purely tuberculous empyema; and it may be assumed. for practical purposes, that there is always an underlying lung tuberculosis. These two considerations being granted, the contra-indication for open drainage in the treatment of these cases is obvious. In many instances, other organisms are associated with the tubercle bacillus in the pleural fluid, mixed infections; but the underlying pleural and pulmonary tuberculosis still constitute a strong contra-indication to thoracotomy.

The resection of one or more ribs to facilitate drainage of the thoracic cavity was brought into general use by König in 1872. The mortality of empyema was at once materially lowered by rib resection, and it is not surprising that this operation was believed to be indicated whenever pus was found in the pleural cavity. In the course of the next twenty years, objections began to appear from many observers to the use of open drainage in empyema occurring in patients with pulmonary tuberculosis. It was found that the pleural cavity failed to close; that a sinus persisted, and that the tuberculosis in the lungs frequently became more active and progressed rapidly to a fatal termination. Even if this did not occur, chronic suppuration almost invariably continued indefinitely, extensive thoracoplastic operation being required in attempts to obliterate the rigid and infected pleural cavity. Fowler[1] recorded the growing dissatisfaction with this situation, stating

that "Franzel, Fielding, and Senator entirely discountenanced thoracotomy and rib resection in tuberculosis cases, preferring repeated puncture." Since then the indications for open drainage of tuberculous empyemas have been gradually but markedly restricted.

The bacteriology of thoracic empyema came in for early study both by cultures and by stained smears; but as the tubercle bacillus did not grow with ordinary culture methods and was often hard to demonstrate in the smear, it was frequently overlooked. In Lord's[2] series of purulent effusions, 18 per cent were noted as sterile; and, although it was recognized that many of these cases were probably tuberculous even the approximate number was not indicated. Calmette states that tubercle bacilli are not numerous in tuberculous empyema, while Letulle notes that they may be present in inconceivable numbers in this condition. The general expression in the literature indicates that while the tubercle bacillus is often difficult to find in the serous effusions, it is more numerous and more easy to demonstrate in the purulent cases. This coincides with our experience. Repeated search should show them in most instances. The literature on the pathology of tuberculous purulent effusion is very limited. Peron[3] describes empyema tuberculosa, and Calmette,[4] in his recent work, writes of cold abscess of the pleura, associating it with destructive tuberculous lesions elsewhere in the body. Letulle,[5] in a very clear account of tuberculous empyema, describes the character of the pus and of the deep infiltrating caseous lesions found with this exudate, and ascribes to it a bad prognosis. The determining factor in producing a purulent rather than a serous exudate, containing only tubercle bacilli, is probably to be found in the amount of infectious material suddenly poured into the pleura, as would occur with the rupture of a caseous focus. In other words, the question appears to be one of dosage.

Assuming a purulent effusion of the pleura, not definitely metapneumonic or postinfluenzal, the greatest

care should be used to exclude tuberculosis before instituting open drainage, since cases of empyema showing no tubercle bacilli almost universally heal promptly, while those having tubercle bacilli rarely do so. Careful and repeated search for tubercle bacilli in the pleural fluid and also in the sputum should be made. The lungs should be carefully examined and the past and present history considered with the possibility of pulmonary tuberculosis. So-called sterile pus will, of course, be considered a strong indication of the tuberculous nature of the effusion; but the presence of pus organisms does not necessarily argue against a tuberculous basis. The demand for immediate open drainage in empyema is rarely so great as to preclude sufficient time for such investigation. Even in the most careful hands, occasional mistakes are made. The sputum is negative for tubercle bacilli; the aspirated pus is negative for tubercle bacilli; the pleura is drained, but fails to close. Tubercle bacilli later are found in the discharge.

Cases which are purely tuberculous may develop in various ways. They may begin insidiously, coming to light in the course of routine examinations. As Babcock[6] stated some years ago, "A consumptive may be none the worse for carrying about a pint or more of innocuous pus in his pleural cavity." An effusion which at first is found to be serous may be found after one or more tappings to have become seropurulent and later purulent. Such an event may develop in the course of artificial pneumothorax treatment of pulmonary tuberculosis.

The introduction of artificial pneumothorax has added materially to our knowledge and experience with tuberculous empyema. Serous effusions eventually occur during the course of artificial collapse in the majority of instances, and approximately 5 per cent develop purulent effusions. Many of these are the direct result of lung rupture, and not infrequently are converted into the spontaneous type of pyopneumothorax.

Artificial pneumothorax has taught us that, first, a diseased lung can be collapsed with benefit and should be re-expanded with great caution, and secondly, the development of a turbid or even purulent effusion in the course of a pneumothorax treatment is not necessarily serious, and this condition can best be met by aspiration and replacement by air. The rupture of a caseous focus of the lung or bronchial glands, rich in bacilli and toxins, results in a stormy onset with high fever and great toxemia and the fairly rapid development of a purulent tuberculous effusion. Whatever the mode of development, or course, of infection, provided the purulent effusion remains purely tuberculous, there are no indications for open drainage. These cases should be treated by aspiration, to be repeated as frequently as necessary, with simultaneous replacement by air to protect the underlying lung. In pyopneumothorax with open bronchial fistula, the same method should be used, preserving a neutral intrapleural pressure to give the opening into the bronchus an opportunity to close. No good can accrue to the patient by adding a secondary infection, as must inevitably occur if a trochar or tube is used for permanent drainage.

In tuberculous empyema with mixed infection, the indications for treatment are clear, but, unfortunately, they cannot always be met. The secondary infection should be combated, if possible, without open drainage. We must admit, however, that our efforts in this direction will not always be successful. The presence of a mixed infection in tuberculous empyema when no bronchial fistula exists is no indication for open operation.

Aspiration with replacement by air, repeated as frequently as necessary to keep down the effusion and limit the absorption, will not infrequently control the secondary infection. It should always be given as thorough a trial as the condition of the patient will permit. The importance of the outcome of the tuberculous lesions must never be lost sight of. When a definite bronchial fistula exists and does not close after neutral

pressure has been maintained for some time, we are forced either to allow the patient to die within a few days or weeks, or to drain openly and, by so doing, prolong life, but fully expecting the drainage to continue throughout the existence of the patient. If such drainage is instituted, it is preferably done with the smallest amount of trauma (trochar and catheter).

Not much need be said of technic. Replacement of the pus withdrawn by air is essential, unless a permanent bronchial fistula exists, to maintain lung collapse and prevent pain and shock. The pneumothorax outfit should be used for this purpose. A small needle has the advantage of limiting the danger of infecting the needle track (tuberculoma), but must, of course, be large enough not to block. Particular care should be taken to determine definitely by the manometer during the aspiration whether or not a bronchial fistula exists. This should be tested on every possible occasion, as these fistulas, it is well known, are liable to be closed at one time and open at another. Adolph Meyer reported a case before the National Tuberculosis Association, in 1920, of the expulsion of the contents of an empyema through a bronchial fistula by the introduction of air above the fluid level. This has no advantage unless the empyema is so situated that it could not be easily and conveniently reached by external puncture.

The introduction of antiseptic fluid into a closed empyema cavity apparently does little good. If practically all the pus can be aspirated, alcohol in strength from 50 to 95 per cent or 2 per cent solution of formaldehyde in glycerine seems to relieve the sepsis at times. Gentian violet has not proved successful. Surgical solution of chlorinated soda (Dakin's solution) is contra-indicated and of no avail. The effect of these fluids mentioned is probably enhanced by washing out previously with salt solution.

As tuberculous empyema is a complication of pulmonary tuberculosis and, frequently, of its advanced stages, it goes without saying that the prognosis is

often grave. The most favorable cases are those without marked lung involvement. Unfortunately, many of the cases encountered are terminal phases of the lung disease or are identified with late and disastrous accidents of the pulmonary tuberculosis, such as the rupture of large cavities into the pleura in patients whose resistance is already exhausted. There still remains, however, a considerable number of cases in which the duration of life and comfort of the patient for the next few years depend entirely upon whether the surgeon is able to resist the dictum that pus in the pleura, particularly when accompanied by fever, requires thoracotomy.

A few case-histories are presented to emphasize that:

1. Open drainage in tuberculous empyema is an unsatisfactory and often a disastrous procedure when the end-results are considered.

2. The presence of other organisms in the pleural pus besides the tubercle bacillus (mixed infections) can be successfully treated by aspiration and replacement by air, which is contrary to the usual teaching.

3. The tuberculous base of empyema is often overlooked.

During the last few years, I have observed twenty-eight cases of tuberculous empyema with mixed infections. Eight of these were treated by aspiration, and twenty by open drainage. I have treated all of the aspiration cases, but did not see many of the open drainage cases until operation had been performed. Only those cases in which there was persistent bronchial fistula were opened. Of the patients treated by open drainage, nine are dead, only one being considered as at all well. This was a patient treated by trochar and catheter, and he is at work and doing well. All of the others must be classed as more or less chronic invalids. Of the eight patients treated by aspiration, one is dead. All the others are working and in good health.

The first case is the only case of open drainage in which I had an entirely satisfactory result. It is submitted as the misleading exception to the general rule.

REPORT OF CASES

Case 1.—J. D. a man, admitted to the Union Printers Home in 1914 with extensive tuberculosis of the left lung, was treated by artificial pneumothorax for about three months, when he suddenly became acutely ill and a spontaneous pneumothorax was diagnosed. Pus rapidly accumulated in the left pleural cavity, showing tubercle bacilli and many streptococci. He was aspirated for a little more than a month, and was then drained by trochar and catheter. Drainage was continued for about twenty months and then the sinus closed. He was discharged from the Union Printers Home in 1917, has been working continuously since that time, and is apparently in excellent condition.

The next three cases are more typical of the after-history of the drainage cases.

Case 2—Mrs. J. L. I. had had what was probably pleurisy with effusion sixteen years before. Some time after this, following delivery, she was ill in bed six weeks with chills, fever and pain in the right side. Five years before I saw her, during an attack of bronchitis, she suddenly expectorated a quantity of pus and, following this, began to have a rise of temperature. Two months later she had an extensive empyema with a mixed infection, which I drained. Improvement was marked, but a large sinus and cavity remained which proved to be tuberculous. Two years later eight ribs were resected. Convalescence was stormy, but she has since improved markedly but still has a sinus and cavity.

Case 3 is also a tuberculous empyema which was overlooked until drainage had been performed.

Case 3.—Mrs. C. was delivered in April, 1921, and five days later developed a continuous rise of temperature which frequently ranged from 101° to 104°. About a month after delivery, she came to Colorado Springs. She was found to have fluid in the left chest, reaching to the sixth rib posteriorly. Aspiration was at first unsuccessful, but three days later pus was found and drained, and tubercle bacilli were then found in the pleural fluid. A few days later, an effusion developed in the other pleural

cavity. She became septic and died of acute miliary tuberculosis two months after delivery.

Case 4.—T. O. T., a man, had influenza in 1918, and was in bed six weeks, during which time fluid accumulated in the left chest and was aspirated. Three months later, aspiration was again performed, and thereafter this was repeated at intervals of three weeks. Six months after his illness had begun a rib resection was done and three drainage tubes inserted, one of which was soon lost in the cavity. Somewhat later four additional ribs were removed, and the lost tube was recovered. A year after the drainage was begun, the sinus was enlarged and the tube dispensed with as the cavity was not draining properly. The cavity was irrigated with saline and iodine solutions. Up to this time no tubercle bacilli had been found in the pus. In July 1920, eighteen months after the beginning of his illness, he consulted my colleague, Dr. Giese, who diagnosed tuberculous empyema. The sputum was negative, but the pleural pus contained tubercle bacilli. During the last year and one half efforts have been made to reduce the size of the cavity. Intensive irrigation with surgical solution of chlorinated soda was used and the sinus finally closed, for a time. During the interval when the sinus was closed, formaldehyde and also alcohol were tried. Last August, it became necessary to again put in drainage tubes. Nov. 9, 1921, I resected six inches of the eighth and ninth ribs. This case illustrates not only the difficulties in the after-care of drainage cases, but also the fact that the tuberculous nature of the empyema may escape detection for a long time.

It is a matter of satisfaction to turn to three of the cases in which aspiration was performed.

Case 5.—Miss E. G. developed pulmonary tuberculosis in 1919, and for a year and one half was under the care of osteopaths and quacks. She was first seen last January when suffering from a recent spontaneous pnemothorax of the valvular type with a positive intrathoracic pressure. This pressure gradually decreased for three months, when she developed a purulent empyema of mixed type. Aspiration was performed and air was injected at intervals of about two weeks during the summer of 1921. She has gained thirty pounds (13.6 kg.) she takes a reasonable amount of exercise, and the Roentgen ray reveals very little fluid in the pleura at the present time.

Case 6.—F. M., a man., in 1914 developed active pulmonary tuberculosis and soon went for his health to Phoenix, Ariz., where he almost immediately began to have hemor-

rhages with high fever and rapid loss of weight. Artificial pneumothorax was induced on the right side, which controlled the bleeding. He was given three subsequent pneumothorax treatments of from 600 to 700 c.c.,when fluid developed. This was at first straw colored, but later became purulent. Aspiration was performed every two weeks for five months, when he came to Colorado, in June, 1916. He then weighed 115 pounds (52 kg.) had a temperature of about 100,° and had complete aphonia. Soon after his arrival his temperature rose to 104°, and thirty-two ounces (946 c. c.) of thick, purulent fluid were aspirated. Aspiration was repeated every other day for a time and the interval increased gradually to once a week, then two weeks, then three weeks and so on until now aspiration is performed every eight or ten weeks. At present he weighs seventeen pounds (7.1 kg.) above his usual average, and he has worked for the last two years. There is no cough or expectoration.

This case was cited to show that long-continued aspiration often offers an excellent chance of recovery. The aspirated fluid always contains tubercle bacilli. In the earlier aspirations there were always mixed infections. At present no mixed organisms can be found.

Case 7.—Mrs. J. P. P., aged 32, came to Colorado in August, 1914, just after a diagnosis of tuberculosis, although she had had pleurisy during the preceding year at various times. She did not do well under hygienic and dietetic treatment, and artificial pneumothorax was begun in September, 1915. This was completely successful and was maintained for two years without any particular difficulty. In August, 1917, she developed fluid in the pleural cavity, which rapidly changed to pus and was aspirated every one to three weeks to March, 1918. After a time aspirations were less frequent, the last occasion being in November, 1918. Since that time she has had no aspiration, and the lung has been allowed to expand. This fluid was frankly purulent, and contained many secondary organisms as well as tubercle bacilli.

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DISCUSSION

Dr. Oscar H. Shere (Denver, Colo.): I do not believe this important subject should be permitted to go by without some discussion. I brought a number of slides which I expected to show in connection with this paper, but our time is so limited I will not burden you with them.

I merely wish to accentuate one or two points brought out by Dr. McKinnie. Tuberculous empyema should not be treated along the lines of general empyema. The essayist did not bring out one particular point, namely, that tuberculous empyemata should be divided into two general classes. One is the empyema which follows pneumothorax first; this in turn is followed by a serous effusion and later by purulent exudate. That is one form of empyema. The other form of tuberculous empyema, which is by far the more common, is that which follows rupture of the lung. Those of you who have followed up the work of the empyema commission are doubtless familiar with the theory of Moscovitz, that empyema is due to rupture of the lung. We have had sufficient post-mortem evidence in our work to show that all cases of tuberculous empyema are due to rupture of the lung. I have a few slides illustrating that tuberculous empyema clears up within three or four years without any operative procedure, not even aspiration or drainage. On the other hand, I can show you cases of empyema in which I was compelled to drain because of a general toxic process. You cannot apply general treatment to all these cases: they must be treated individually.

I have a slide of a case of empyema in a man with a discharging tuberculous sinus, which has existed for twenty-eight years, yet he is working right along. In some cases a discharging sinus of long standing does not interfere with the man earning a livelihood.

There is one point I would emphasize, and that is that, contrary to what has been said or taught by a number of writers on the subject, in the true empyema exudate tubercle bacilli will invariably be found. In an article which appeared in the *American Review of Tuberculosis* in 1919 we tabulated a series of some twenty-odd cases, in which this point was definitely established.

Dr. Mckinnie (closing): Dr. Shere and I have no quarrel as to classification of these cases, because these empyemas can be classified in a half dozen different ways. We have difficulty as to how to classify them and make them clear to you. I do not want to leave the impression that I am handl-

ing purely tuberculous empyemas. My great plea has been that many of the mixed infectious empyemata can be cured or alleviated better by aspiration or replacement by air or fluid, than if we hastily rush in and open them up.

I distinctly stated that the indications for the treatment of such cases are very clear, but, unfortunately, we cannot always carry them out. Many of these cases have to be opened to prolong life, and on the whole they enjoy a modicum of comfort, but the carrying of a tube for twenty-eight years, as in the case sited by Dr. Shere, gets to be exceedingly burdensome to the individual.

PERIRECTAL ABSCESS COMPLICATING* INTRAPERITONEAL INFECTIONS

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One of the most important phases of the development of surgery of the last decade is the decrease of mortality of general peritonitis, the most common cause of which is, of course, the ruptured or the gangrenous appendix. The cause of this decrease in mortality is due to the better understanding of the physiology of the peritoneum and of its resisting and recuperative powers, but, above all, the realization of the importance of removing the original cause of infection. Another reason for this lessened mortality is due, in my opinion, to the use of gas-oxygen anesthesia in the cases where the resistance is already lowered by the severe sepsis. It is, however, the recognition of late complications, particularly the development of late abscesses, one, two, or even three weeks after the original operation, of which I wish particularly to speak.

There are two types of peritoneal infections which are particularly likely to be followed by secondary abscesses. The retrocecal abscess, so frequently followed by subphrenic abscesses, and those cases of general peritonitis with the original source of infection deep down in the pelvis, which are so frequently followed by secondary pelvic abscesses. The early recognition of these conditions is the most important factor in their cure, as a patient already run down by a long period of sepsis is apt to be carried off by a recurrent secondary infection. The post-operative course of a general peritonitis in which the

*Read by title in the author's absence.

cause of the infection has been removed and adequate drainage inserted is, as a rule, more or less typical. In these cases that recover the general symptoms, as a rule, subside within the course of five or six days; the only thing left is the long wound healing and the weakness incident to and following the infection. Any deviation from this course should immediately cause the surgeon to be on the lookout for complications. This is particularly true of a rise in temperature which persists two or three days, coming on two or three weeks after the original operation. If no infection can be discovered in the wound or in the interstices thereof, there are two complications which should always be suspected. The first and most common of these is the subphrenic abscess, which is occasionally very difficult to find and still more difficult to treat. This condition is particularly difficult to diagnosticate, as it reaches, as a rule an advanced stage with only subjective symptoms,—that is, there may be a complete absence of pain in the chest. If a careful chest examination is made the high liver dullness, or rather the obliteration of the lower thoracic resonance, is striking. One of the earliest symptoms which I have found of value in the diagnosis of these cases is the absence of diaphragmatic mobility. In these cases fortunately the *x*-ray is of paramount importance, and frequently leads to a diagnosis. However, this may be confusing, for the right side of the diaphragm is frequently of a decidedly higher level than the left side. Once diagnosticated the only treatment is early evacuation of the pus, as a diaphragmatic abscess can make tremendous inroads and can become very large in a very short time because of the loose areolar space between the liver and the under surface of the diaphragm.

It is, however, of a more uncommon complication which I wish to speak, and which, I feel sure, is not infrequently overlooked and may occasionally lead to a fatal outcome in a case which might otherwise

be brought to a successful termination,—that is, pelvic abscesses pointing into the rectum. In a paper read before the Surgical Society in 1920, MacLaren reported several cases of this kind. It is only necessary to bear this complication in mind and to make frequent rectal examination on those cases in which the temperature remains above normal longer than it should, or in those cases which have secondary rises in temperature with accompanying symptoms of sepsis some weeks after their return to normal. This case which I wish to present is typical of this class of cases:

Mrs. C. G. admitted to the Jewish Hospital on the third day following beginning of her abdominal pain. There was a typical appendicitis with general peritonitis. On admission the temperature was 102°; pulse, 136; leukocyte count, 20,000; polymorphonuclears, 80 per cent. On March 16, 1921, under gas-oxygen anesthesia, a gridiron incision was made, and gangrenous appendicitis with general peritonitis was found. There was a particularly large accumulation of pus in the pelvis. The wound was not closed, but very large cigarette drains were inserted, extending into the pelvis, and at the same time a suprapubic stab wound was made. Culture of the pus showed gram-negative small bacilli, bacilli coli, and a few large gram-positive bacilli.

After operation the usual treatment for these cases was followed out,—hot moist dressings to the abdomen, slight Fowler position, and salt solution per rectum. The postoperative recovery was rather rapid, although the temperature never came to normal, remaining for the next six or seven days around 100°. On March 29, 1921, the temperature suddenly rose to 103,° with a chill. At that time a rectal examination disclosed a large bulging abscess, pointing in the anterior wall of the rectum. The leukocyte count was 29,000, with the proper proportion of polymorphonuclears. Under light gas-oxygen anesthesia a stab wound was made in the anterior wall of the rectum and a large T drain inserted. Unlike most of these cases the temperature remained fairly high for four or five days, and then gradually returned to normal.

The patient was discharged on April 18, with a small granulating wound in the abdomen.

I quote this case as typical of a class of cases in which by careful observation a post-operative complication can be early recognized and a possible fatality avoided, and at least a more rapid convalescence assured.

In Memoriam

Joseph Ransohoff

Opportunity to acquire knowledge is given to every American, but the art of transmitting knowledge is given to but few. Our craft numbers many men of superior attainment who reflect their brilliance in action rather than in speech, in the sick-room rather than in the forum. In our ranks are many doctors who possess the ability to think connectedly and to make accurate deductions and acute discernments, but as teachers they are abject failures.

Dr. Joseph Ransohoff was a notable exception to this general rule. He was a man of ample mental capacity, and he made the most of his opportunity. The history of his life is an encouraging example of what an American boy born in humble surroundings may accomplish if he has the will to do.

His literary attainments were well grounded. He wrote well, and was a ready and forceful speaker in the realm of medicine and surgery.

But the writer of this, one of his pupils, will ever remember Dr. Ransohoff as the teacher,—a teacher with an easy flow of simple, comprehensive language; a teacher possessing an elegant diction with a clear enunciation and a superb speaking voice.

His lectures and clinical demonstrations were profusely illustrated by tale and story drawn from remote and unexpected sources. They were presented in a voice punctuated by numerous harmonious inflections and just enough physical action to indelibly impress his message upon the minds of the students, all of whom listened with rapt attention.

In the ward, amidst the miseries and sufferings of humanity, his personality as a doctor and teacher shone most brilliantly. His bedside demonstrations were instructive and impressive alike to student and patient, who never ceased to marvel at the numerous "points" elucidated by this master mind in clinical teaching.

Medical and surgical data were so intimately interwoven with his clinical demonstrations as to create reverence for that well-nigh forgotten volume of the medical historian and to impress the patient with the thought that his was easily the most interesting and rare disease under treatment in the hospital, although the patient may have been suffering from shingles.

He was an excellent diagnostician, and his vision penetrated far afield above and beyond mere surgical diagnosis. He was a doctor by profession, a surgeon by occupation, and a teacher by choice. He taught for forty consecutive years in the arena of his Alma Mater.

He retained his youthful love, esteem, and enthusiasm for his chosen mistress, medicine, to his dying breath.

His familiarity with human anatomy and pathology, his ability as a diagnostician, his mental poise and acquired

dexterity, combined with sound surgical judgment born of experience, rendered him a very competent operator.

Of a genial, optimistic disposition, he loved a good cigar; and under the magic spell of its solacing influence he would become retrospective and dash off passage after passage from the classics to the delight and wonderment of his auditors.

His life was an example of what the historian said of Demosthenes, the Athenian:

"But virtue, like a strong and hardy plant, will take root in any place where it can find ingenious nature and a mind that has no aversion to labor and discipline. Therefore, if our sentiments on conduct fall short of the point they ought to reach, we must not impute it to the obscurity of the place where we were born, but to our own little selves."

The writer of this has said all of the foregoing to Dr. Ransohoff while he was alive and in the flesh to enjoy the commendations of his students and fellow-workers, and he now deems it a privilege to present this appreciation to the Fellows of the Western Surgical Association, of which Dr. Ransohoff was an honored member.

W. D. Haines, M. D.

Elmo Morgan Sala

Dr. Elmo Morgan Sala, of Rock Island, Illinois, died suddenly at St. Anthony's Hospital, February 17, 1921, at the age of 50 years.

The same morning he had operated on a patient, and on returning at 1 P. M., and while conversing with one of the Sisters, he fell dead without warning. He had, before the day of his death, been confined to his house on account of some affection of his heart for a period of two weeks.

Dr. Sala was born at Bloomington, Wisconsin, September 8, 1870. His father, Dr. Orlando P. Sala, was a practicing physician, as was also his grandfather and great grandfather. Dr. Sala's grandfather had at one time practiced medicine at Rock Island. With such an ancestry it is not strange that the great grandson should have acquired distinction.

Dr. Sala was educated in the Bloomington common and high schools. After completing his preliminary education, he taught in his home schools one year. He entered the Medical Department of the Iowa State University and graduated from the Keokuk Medical College, March 8, 1892. On the day following his graduation he opened an office in Rock Island, where he practiced to the day of his death. In 1901 Dr. Sala attended a course in the Chicago Post-Graduate College and in 1911 a course in Vienna where he specialized in X-ray work. Dr. Sala became a member of the Western Surgical Association in 1902 and assumed an active part in its work both in preparing papers and in discussions. He manifested an active interest in fracture work and contributed several valu-

able papers illustrated by many X-ray plates of a high degree of artistic merit. Dr. Sala rarely, if ever, missed a session of the Association and always brought a message of value. In addition his genial presence contributed much to the social pleasures of the meetings.

Dr. Sala was active in medical organization. He was a member of the Illinois State Medical Society, a Fellow of the American Medical Association, and a Fellow of the American College of Surgeons, and a member of several local medical societies.

When the Government needed medical officers in the war with Germany, Dr. Sala early offered his services, was commissioned a major, and assigned to important duties in hospital service.

Attendance upon the meeting of the Association at Los Angeles in December, 1920, his active work as a member of St. Anthony's Hospital staff, and his activity in private practice conveyed the idea of vigorous health. His sudden death created a profound impression in the community in which he was so much respected.

On December 28, 1892, Dr. Sala married Miss Mary Elizabeth Krell of Rock Island, who survived him. One child was born to them and died in infancy.

David S. Fairchild, Sr., M. D.

Charles Henry Lemon

Charles Henry Lemon, son of John and Adelaide (Du Bosque) Lemon, was born in Philadelphia on January 28, 1863. He was educated in the public schools of Philadelphia and in the University of Pennsylvania. He graduated in 1890 from Rush Medical College and moved the same year to Milwaukee. Here he soon became Surgeon to the Milwaukee Street Railway Company and thus became deeply interested in industrial surgery.

His many achievements are noteworthy in two respects. One, the effective organization of medical associations connected with corporations; the other, the treament of fractures.

Not only did he have an enormous experience in the treatment of fractures, but he had also peculiar ability in this line of work. His results obtained in the presence of serious complications were truly remarkable. The needs of mechanical assistance in treating fractures of the legs led him to devise a fracture table which bears his name.

The most outstanding characteristic of Doctor Lemon was his untiring, enthusiastic devotion to his work. His friends are many and their affection for him is still a living influence.

He is survived by a widow, one son, and a married daughter.

John L. Yates, M. D.

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Connell, F. Gregory
Wausau
Smith, Joseph F.

INDEX

Abdomen, the acute traumatic 159

Abdomen, the acute non-traumatic 173

Back, the lesser injuries to the, and their industrial signficance 71

Bailey, Frederick, W.
The recognition and treatment of post-operative complications 253

Beck, Emil G.
Radical surgery as an aid to efficient radiotherapy in the apparently hopeless cases of carcinoma 85

Black, Carl E.
Tumors of the breast 371

Blood pressure in surgical cases 247

Carcinoma, radical surgery as an aid to efficient radiotherapy in the apparently hopeless cases of 85

Carpal bone fracture 61

Cholecystostomy or cholecystectomy—which? 145

Common duct repair 131

Corbett, J. Frank
Blood pressure in surgical cases 247

Cottam, Gilbert Geoffrey
Intestinal obstruction 187

Coughlin, W. T.
Injuries of the face and jaws 223

Cystadenoma, papillary, of the male breast 361

David, Vernon C.
Papillary cystadenoma of the male breast 361

Davis, Byron B.
Total removal of the scapula for primary giant-cell sarcoma 117

Eastman, Joseph Rilus
A continuous knotted loop suture: its field of application 233

Empyema, tuberculous 401

Evans, John L.
Ectopic pregnancy 345

Face and jaws, injuries of the 223

Fay, Oliver J.
The lesser injuries of the back and their industrial significance 71

Fracture, the pathology of carpal bone-dislocations 61

Grant, W. W.
The non-traumatic "acute abdomen" 173

Hernia, diaphragmatic 199

Hernia, sciatic 211

Hernia, traumatic and industrial 311

Infections, intraperitoneal, perirectal abscess complicating 413

Intestinal obstruction 187

Judd, E. Starr
Excision of ulcer of the duodenum 333

Kerr, A. A.
Some modern methods of minimizing mortality in surgical cases, with report of the mortality in 1518 surgical cases at the Holy Cross Hospital, Salt Lake City, Utah, from January 1 to September 1, 1921 297

Lockwood, Charles D.
The general surgeon, past, present and future 23

Lung, surgical treatment of abscess of the 389

Mc Arthur, Lewis L.
Common duct repair 131

Mc Kinnie, Lewis H.
Tuberculous empyema 401

Mann, Arthur T.
Diaphragmatic hernia 199

Mortality in surgical cases, some modern methods of minimizing 297

Nifong, Frank G.
Acute osteomyelitis: regeneration of the entire shaft of the humerus 39

Osteomyelitis, pathology of 51

Osteomyelitis, acute 39

Porter, Miles F.
Cholecystostomy or cholecystectomy—which? 145

Post-operative complications, the recognition and treatment of 253

Pregnancy, ectopic 345

Radiotherapy, radical surgery as an aid to efficient, in the apparently hopeless cases of carcinoma 85

Ransohoff, J. Louis
Perirectal abscess complicating intraperitoneal infections 413

Sarcoma, total removal of the scapula for primary giant-cell 117

Shere, Oscar M.
Surgical treatment of abscess of the lung 389

Speed, Kellogg
The pathology of carpal bone fracture-dislocations 61

Stokes, Arthur C.
Pathology of osteomyelitis, with special reference to growing bone 51

Summers, John Edward
Sciatic hernia, report of a case complicated with myoxomatous tumor of the scrotum 211

Suture, a continuous knotted loop 233

Traumatic abdomen, the acute 159

Traumatic and industrial hernia. Report of the special committee of the Medical Section of the American Railway Association 311

Tumors of the breast 371

Ulcer of the duodenum, excision of 333

Witherspoon, T. C.
The acute traumatic abdomen 159

In Memorium 417

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~~HB~~
~~154~~